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**DESIGN METHODOLOGY FOR A COMMUNITY RESPONSE
QUESTIONNAIRE ON SONIC BOOM EXPOSURE**

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EXECUTIVE SUMMARY

Proposed projects for future supersonic aircraft have renewed interest in determining the community response to sonic boom exposures. Future community surveys of the annoyance reactions of residents to supersonic overflights should concentrate on two major objectives. The first objective is to determine a quantitative dose/response relationship between physical measures of sonic boom events and the average annoyance response elicited by those events in the community. The second objective is to assess the community annoyance response to different shapes of sonic boom signatures.

The present study developed a preliminary draft questionnaire concerning community response to sonic booms. This preliminary questionnaire was developed through interviews in two communities that had experienced supersonic overflights of the SR71 airplane for several years. It was estimated that these SR71 overflights occurred about once per week on the average, and produced a sonic boom of about 0.5 to 1.0 psf. Even though SR71 flights had ceased about six months prior to the interviews, people remembered hearing the sonic booms. Altogether 22 people living in central Utah and 23 people living along the Idaho/Washington state border took part in these interviews. The draft questionnaire was constantly modified during the study in order to evaluate different versions.

The results of these interviews were used to improve and enhance the sonic boom questionnaire. Based on the data collected, a proposed community response survey instrument was developed for application in a full-scale sonic boom study. In addition, some preliminary data were collected on the degree of annoyance due to sonic booms experienced by residents living in the two sampled regions.

On the average, residents reported little to moderate annoyance from sonic booms, but reported that they had experienced startle reactions. Some sleep disturbance was noted. The vast majority of respondents heard the sonic booms in their areas, but memories concerning the frequency and time of sonic boom events were highly variable and sometimes contradictory. Windows often rattled, however little structural damage was reported to homes or other buildings. Most people did not consider sonic booms to be a particularly severe problem in their environment. This low level of annoyance in the community may have been due to the fact that SR71 supersonic overflights had actually ceased some months before the interviews. There were several strong negative reactions, however, particularly associated with outdoor forestry activities.

These preliminary data on the degree of possible community annoyance caused by sonic booms should not be generalized. The small number of respondents, constantly varying questionnaire and retrospective nature of the survey do not support meaningful statistical inferences.

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1.0 Introduction

1.1 Background for the Present Study

Recent studies by the National Aeronautics and Space Administration (NASA) and by the United States aircraft industry indicate that the technology can be developed for future environmentally acceptable and economically viable high-speed civil transport aircraft. However, considerable research, development and validation efforts will be required. The current NASA research program addresses the important environmental issues of ozone depletion, airport noise and sonic boom that surround such high-speed civil transport aircraft. As concerns the sonic boom that would be created by such an airplane, two important issues can be identified. First, it is critical to determine a level of sonic booms which would be acceptable in a community that might be subjected to supersonic overflights. Second, a sufficient understanding of the community response to sonic boom exposure must be developed in order to evaluate research and development efforts at sonic boom reduction.

1.2 Previous Sonic Boom Surveys

During the 1960's and early 1970's a series of social surveys was conducted concerning community exposure to sonic booms. A list of 12 such surveys may be found in Table 1, with full citations given in the Reference Section. As may be seen in the Table, about half of these surveys were conducted in Europe and half in the United States. They were all conducted over 15 years ago. Aircraft technology has developed over that period, and public opinion is likely also to have changed. Moreover, none of these previous sonic boom surveys produced an adequate quantitative dose/response relationship. None produced a relationship that could be readily compared with the dose/response relationships found in the large number of subsonic aircraft/airport noise surveys that had been published since that time. Based on these subsequent subsonic aircraft noise surveys, relatively stable and agreed-upon land use criteria have been established for the acceptability of civilian aircraft noise around urban/suburban airports. These criteria have proven effective both as technology drivers to influence aircraft design and as land use planning tools for airport development.

A dose/response relationship between physical sonic boom exposure and community reaction to that exposure, especially a relationship which could be compared to current subsonic aircraft noise criteria, would represent a major advance. Such a relationship would provide a technical foundation for the many subtle design and operation tradeoffs inherent in several important future aircraft and aerospace developments.

TABLE 1

COMMUNITY SURVEYS OF SONIC BOOM REACTIONS

YEAR CONDUCTED -----	SURVEY -----	AUTHOR -----	PUBLISHED DATE -----
1961	St. Louis Sonic Boom Study	Borsky	1962
1963	Welch Village Impulse Noise Study	Webb & Warren	1967
1964	Oklahoma City Sonic Boom Study	Borsky	1965
1965	French Regional Sonic Boom Survey	de Brisson	1966
1966	Edwards Air Force Base Resident Sonic Boom Survey	Kryter et al.	1968
1967-68	SR-71 Supersonic Aircraft Noise Study	Tracor	1970
1969	Meppen Sonic Boom Field Experiment	May	1972
1970	French Sonic Boom Survey	Bremond	1974
1971	French Concorde Sonic Boom Study	Bremond	1971
_____	Trangslet Sonic Boom Study	Rylander et al.	1972
_____	Nausta Research Camp Sonic Boom Study	Rylander et al.	1972
_____	Burgsvik Sonic Boom Study	Rylander et al.	1974

1.3 Goals for the Present Study

The present investigation represents a first step in developing an updated survey for determining the community response to sonic booms. A preliminary draft questionnaire was formulated. This draft questionnaire was pretested in two geographical regions that had been regularly subjected to sonic booms from the SR71 aircraft for several years. These SR71 supersonic overflights had ceased about 6 to 7 months before the field pretest was conducted, but memories of the sonic booms were expected to be of sufficient strength for pretesting the survey instrument. In particular, the present investigation had the following specific objectives:

1. To develop a preliminary core questionnaire to measure contemporary community response to sonic booms.
2. To relate that questionnaire to previous social surveys concerning sonic booms.
3. To relate that questionnaire to previous social surveys concerning subsonic aircraft noise.
4. To incorporate questions that could produce a dose/response relationship in future surveys.
5. To select two sample geographic regions for pretesting the core questionnaire.
6. To select small samples of residents in these regions to serve as pilot test respondents.
7. To administer the questionnaire in a non-structured, informal, face-to-face interview format.
8. To modify the core questionnaire in the course of the pretesting to evaluate different versions.
9. To modify and improve the core questionnaire based on the results obtained.
10. To estimate the degree of community annoyance due to sonic booms experienced in the two regions.
11. To test the effectiveness of a retrospective survey on sonic booms that had recently ceased occurring.
12. To propose an updated community questionnaire instrument for use in a future full-scale social survey.

1.4 Goals for a Future Full-Scale Survey

Any future full-scale survey that might be based on the outcome of the present pilot test would have two primary goals: to

estimate a community dose/response relationship for sonic booms and to evaluate the community annoyance response to different shapes of sonic boom signatures. The relationship between these two goals and the proposed full-scale questionnaire instrument may be found in Appendix A.

1.4.1 Dose/Response Relationship

The first goal of a full-scale survey would be to develop a dose/response relationship for sonic booms which can be compared to dose/response relationships for conventional aircraft. Policy makers need to estimate the extent to which residential populations will be impacted by exposure to sonic booms. The primary measure of impact which is used in planning for conventional aircraft operations is self-reported annoyance on the part of community residents. However, none of the previous 12 sonic boom surveys reported a quantitative relationship between overall community annoyance with sonic booms and variations in measured levels of sonic boom exposure.

The required dose/response relationship could be provided by a new social survey which relates measured levels of sonic boom exposure to standardized annoyance questions. The critical questionnaire development decision concerns the choice of specific sonic boom annoyance questions. One major problem is that conventional aircraft noise surveys have not shared the same annoyance questions. Sonic boom questions must be chosen which can be linked to the largest number of conventional aircraft noise survey results. If any surveys using non-standard questions are also to be included in the comparison, then some empirical basis for the comparison must be developed. A firm foundation for such a comparison could be derived from studies in which the pairs of questionnaire items to be compared are administered to the same population. The simple intuitive approaches used by Schultz (1978) would not be appropriate in this instance.

The present questionnaire has been designed with two questions which provide linkages to some of the most useful studies of community response to conventional aircraft noise. It is proposed, however, that ancillary studies should be conducted to provide transfer functions for other questions which would provide linkages to other important aircraft noise annoyance surveys as well. The present questionnaire could also contribute to developing a dose/response relationship in still another way, by providing a linkage to a previous sonic boom survey. The 1964 Oklahoma City Sonic Boom Survey related measured noise levels to certain unusual, non-standard annoyance references. A new survey could establish a transfer function between the non-standard Oklahoma City annoyance measures and future standardized annoyance measures. If successful, such a transfer function could provide comparable dose/response information for the over 2,000 respondents in the Oklahoma City survey.

The possibility of linking the results to a previous nationwide survey was considered but rejected. The most carefully considered linkage was with a question about moving away because of noise. This question appeared in the U.S. Census Bureau's annual housing surveys in the late 70's and early 80's in several forms (Annual Housing Survey, 1976-1983). Such a question would be valuable if it could be linked to a national norm. The moving away question was not included, however, for the following reasons: (1) the question wording could not be repeated exactly, (2) it is not clear, considering the large geographic area covered by a sonic boom, whether people could effectively move away from the boom or not, (3) the best question is over 13 years old (1977) and (4) even this question was weak because it concerned "like to move" rather than actual plans to move.

1.4.2 Sonic Boom Signature Effects

The second goal of a full-scale survey would be to evaluate the community annoyance response to the low frequency acoustic energy found in sonic booms. New aircraft designs have been proposed which could shape the frequency spectrum of the acoustic energy produced in sonic booms. The primary result would be a substantial reduction in the energy at high frequencies, with little or no reduction in the energy at low frequencies. Such a change in conventional aircraft noise would probably result in a considerable reduction in annoyance as predicted by A-weighted sound levels. It is not clear, however, that a similar reduction in annoyance could be expected for sonic booms. The very substantial energy component at low frequencies can produce vibration and other effects which are not normally present in the noise environments from conventional subsonic jet aircraft. Previous surveys have established that respondents are aware of the effects of these large amounts of low-frequency acoustic energy.

Any new survey needs to obtain further information about the importance of community reactions to the low frequency components of sonic booms. A survey could do so through detailed probing of annoyance caused by rattles, moving structures, perceived damage, and sound which respondents say they could "feel". The relative importance of such vibratory phenomena as compared to conventional noise phenomena should give some indication about whether or not reductions in energy at high frequencies will reduce overall annoyance with sonic booms. An indirect indicator of the importance of vibration-related phenomena may be also provided by contrasts between indoor and outdoor sonic boom annoyance.

2.0 Method

2.1 Sample of Respondents

Two geographic regions were selected for implementing the questionnaire pretest. Both regions had been subjected to SR71 supersonic overflights for several years. It was estimated that

these overflights occurred about once per week on the average, and produced a sonic boom of about 0.5 to 1.0 psf. Both regions were in rural areas where the SR71 flight tracks were roughly in the same direction and relatively densely packed. The first region was located in Utah, south of Salt Lake City. This region covered the towns indicated in Table 2, and included 22 respondents. The second region was located along the Idaho/Washington state border. It covered the towns indicated in Table 2, and included 23 respondents. Since more respondents were from Idaho than from Washington, this second region will be referred to as the Idaho region. All interviews were conducted during July 1990. The interviewer drove into each town or rural district and selected average-looking houses to approach for an interview. Interviews resulted from about 80 percent of these initial approaches. Depending upon the size of the town or district, from 1 to 5 interviews were conducted in a given location. The average interview took about 45 minutes to complete.

2.2 Pretest Survey Instrument

The first step was to locate and review the 12 previous studies of community reactions to sonic booms in residential areas. The questionnaires from most of these studies were reviewed in detail. The 1961 St. Louis Sonic Boom Study and the 1964 Oklahoma City Study questionnaires were examined most closely because both had been conducted in the United States and because both explored a wide range of issues in their questionnaires. The second step was to identify the most likely research goals for future sonic boom studies. These goals are described in Section 1.4. At the third step a draft core questionnaire was developed. This questionnaire included two types of questions: questions which were planned for inclusion in future studies, and questions which could provide some insight into the design of future questions. This draft core questionnaire included a large number of open questions.

The survey developer and the pretest interviewer conferred on many occasions before, during and after the field trips to Utah and Idaho/Washington. In this manner, the core questionnaire went through several modifications and revisions in the course of the pretest itself, as indicated in Table 3. These modifications and revisions included:

- (1) Changing the original item or question. The degree of this change varied from a one word substitution to a rephrased question.
- (2) Adding a new item. Added items were intended to provide additional information or clarification on certain topics.
- (3) Reordering items. The sequence of items within the interview was changed in order to group related items. Care was taken to preserve required sequences of items.
- (4) Changing the type of response mode required for certain

TABLE 2
TOWNS IN SURVEY SAMPLE

<u>UTAH</u>	<u>IDAHO/WASHINGTON</u>
Nephi (5)	Moscow, ID (2)
Price (4)	Pullman, WA (2)
Helper (2)	Colfax, WA (2)
East Carbon (2)	Pulouse, WA (3)
Huntington (1)	Endicott, WA (1)
Orangeville (1)	Lacrosse, WA (1)
Salina (1)	Orofino, ID (5)
Richfield (1)	Kamiah, ID (2)
Manti (1)	Weippe, ID (1)
Ephraim (1)	Elk City, ID (4)
Moroni (1)	
Mount Pleasant (1)	
Fairview (1)	

Number of interviewees in each town is indicated in parentheses.

TABLE 3
SUMMARY OF SURVEY MODIFICATION

VERSION OF FORM	NO. OF INTERVIEWS	MODIFI- CATIONS (ITEMS)	NEW/ DELETE (ITEMS)	REORD. ITEMS (PAGES)	NEW RESPONSE MODE/ INSTRUC. (ITEMS)
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Utah

I	5				
II	6	8	3	-	-
IIIa	9	2	1	-	-
IIIb	2	0	2	-	-

Idaho/Washington

IV	6	6	3	8	8
V	5	8	7	4	1
VI	4	1	2	-	-
VII	2	-	3	-	-
VIII	6	-	2	-	-

items. For instance, on several items, interviewees were originally asked to indicate their degree of annoyance by an adjectival category scale. This was changed to a numerical rating scale in many instances.

After the pretest had been completed, further modifications and improvements were made to the survey instrument based upon the data obtained. An annotated version of the final questionnaire that was developed from the results of the pretest may be found in Appendix B. This version gives some of the reasons for including various questions on the survey. Thus, there was no single pretest survey instrument in the present investigation, only an evolving questionnaire that was constantly revised and customized for each application. A sense if this evolutionary change may be gleaned from a comparison of the annotated final version of the survey found in Appendix B with the data presentation survey found in Appendix E.

2.3 Pretest Field Implementation

The first region in which the questionnaire was pretested was in central Utah. Initial inquiries in Provo, Utah, included the police department, an airport manager, a shopowner, and a restaurant employee. These contacts indicated a weak sonic boom response in this immediate area. The survey effort was then directed toward a series of smaller towns thought to be more directly in the path of the noise source. The second region for the survey pretest was along the border between Idaho and Washington. In this instance the sequence of towns was dictated more closely by the SR71 flight tracks. The last town, Elk City, was found through a series of verbal leads from other respondents. This location yielded some of the most intense annoyance responses observed during the entire study.

Interviews were conducted on weekends and week days. Most of the interviews were conducted in the afternoon and evening. This scheduling increased the probability of obtaining a more representative sample of the population at home. The majority of interviews were conducted in the home of the interviewee. A few interviews, however, were conducted in workplaces, such as a government building, motel office, restaurant or museum. Most of the surveys involved only one interviewee. On a few occasions a family member or friend also participated, allowing additional opportunity to elicit information about sonic boom phenomena.

2.4 Data Analysis Methodology

Frequencies of responses were calculated for each item in the pretest survey. For those items which required open responses, verbal categories were created to group the responses obtained, especially in instances where there was little variance in the types of responses given. For example, responses to questions 11x and 11a were grouped mainly into two categories: startle effects and physical manifestations. Responses involving some type of

change in behavior or physical reaction in the person (e.g. the person jumped up) were categorized as "startle effects", whereas responses involving some type of occurrence in the physical environment (e.g. the windows rattled) were categorized as "physical manifestations".

Data from the two geographic regions were separated in order to examine any substantial differences that might exist. In addition, the data were separated according to changes in the format of the questions or responses. However, in the final summary of the data, the data were collapsed across different response formats when these differences proved insignificant. For example, respondents in Idaho were asked to respond to several questions in either words (alternative 1) or numbers (alternative 2). These two response modes were treated as numbers in most instances, and were often expressed as an average in the data analysis.

3.0 Results

3.1 Findings Concerning Survey Design

The field testing was planned to provide overall guidance in the development of the questionnaire, as well as to solve particular question wording issues. Enough information was collected to provide guidance on most, but not all, issues. This information comes primarily from the interviewer's own personal impressions, not from quantitative analyses of the data. In general the exploratory nature of the interviews, the lack of uniformity of interview administration, and the variety of respondent experiences lead to limited generalizability of the data from this extremely small sample of respondents. Thus the main focus of the present study was on the design methodology for the questionnaire itself.

3.1.1 Issues Successfully Addressed

The following issues were successfully addressed in the present investigation:

- (1) Is "sonic boom" a satisfactory phrase for communicating with respondents? The questionnaire used the phrase "sonic boom from jets". The interviewer listened to determine whether respondents were more likely to use some other term. Some respondents were directly asked whether any other term was commonly used. It was concluded that no other common terms were used in the community and that the preferred phrase is "sonic boom from jets". When respondents were asked to describe the noise they employed terms such as "boom", "bang", "crack", "loud clap", or "thunderous". Most of the respondents' descriptions of the sonic boom noise are included in Appendix C.

- (2) Are respondents likely to be using the term "vibration" to refer to low frequency sound which their body can sense? Descriptions of vibration usually focused on objects such as windows which were noticed to rattle. The interviewer concluded that respondents were not usually talking about noise induced vibration in the body when answering questions about "things vibrating or shaking or rattling...".
- (3) What words do respondents use to describe directly experiencing low frequency sound with their bodies? The interviewer frequently probed to see whether or not respondents could describe a sensation of "feeling the boom itself without noticing anything else vibrate". Most respondents did not report any such sensation. Some respondents were able to verbalize similar sensations using words such as "pressure", "whole body", "like a concussion", "not a breeze", or "a sharp rap." More comments are reproduced in Appendix C.
- (4) What is the impact of the wording of the Oklahoma City activity interference questions? Some activity interference questions in the Oklahoma City sonic boom study referred to "your family" and not to only the respondent. Most noise surveys ask about only the respondent's own experiences. In the present pretest some respondents clearly answered the question regarding the "family" by reporting other people's activity interferences. It often was not clear whether respondents were responding for all members in the household inclusive or exclusive of themselves. Since these activity interference items are the only linkage to the Oklahoma City results, it is important to repeat the original wording in the final survey.
- (5) Will respondents feel threatened by questions which probe their certainty about the causes of damage? Very few respondents reported possible damage from the sonic boom. Those who did were not offended when the interviewer asked how certain they were about the sonic boom actually having caused the damage.
- (6) Does the inclusion of several questions on the same topic reduce respondent rapport? Several respondents mentioned the repetitive nature of the questionnaire and at least one mentioned disliking it. Reasonably well focused answers sometimes anticipated future questions. Some of these problems were due to the structure of the pretest. Though there was considerable variation among interviews, most interviews focused on more than one closely related aspect of sonic booms. For any particular aspect of a sonic boom, a general probing question was usually followed by a checklist. The use of checklists following open questions created some problems with repetition. Since the checklists were found to be quite complete, the final questionnaire eliminated most of the open questions.

- (7) Is there any indication that the questionnaire in anyway could have heightened respondents' awareness of problems or willingness to take action regarding the boom? The interviewer was not aware of any cases in which the interview appeared to affect a respondent's orientation toward taking action. The interviewer found at least one person who mentioned that he had not previously considered the possibility of damage. As in this case, it seems likely that a person, who has never thought about an issue before it is raised in an interview, is likely to have very little interest in the topic.
- (8) In what ways do respondents interpret the Oklahoma City question on the legitimacy of complaints? The Oklahoma City analysis removed approximately 30% of the respondents who believed that others should not "complain about these booms if they are annoyed". The author provided the following justification for that exclusion:

"Belief in the appropriateness of complaining about booms if they are annoying, however, was found to be a potential source of serious bias. Those who did not believe people should tell the interviewer of their annoyance even if they were annoyed consistently understated by 10-20% their own reactions to the booms. To be conservative in our findings, it was decided to exclude these questionable and possibly biased respondents from the subsequent main analyses. Major findings will be based solely on those respondents who felt people should express their honest reactions and complain if annoyed." (Borsky, 1965; 102)

The author reported that this reduced the percentage of impacted respondents by only two to three percentage points. It is not clear how the author thought that opposition to complaints would lead the respondent to understate annoyance in an interview. In the Oklahoma City questionnaire, the question follows a series of complaint questions. Thus the question seems to refer to public action, not to communicating with the interviewer. The danger is that the question simply filtered out respondents who were repeating their own lack of annoyance. Such a filter has never been used in any other sonic boom study that might be used for comparison.

In the present study respondents' comments to this question revealed widely varying answers. For some respondents the question seems to function as a question about their own level of annoyance. These respondents justified allowing complaints on the basis of the severity of the sonic booms. Other respondents justified allowing complaints on a "freedom of speech" basis. They stated that people should be free to express their own feelings and complain directly to authorities. Other respondents justified opposing complaining on the basis that the sonic booms were necessary

for national defense. Others responded in terms of whether such complaints could be expected to be effective. There was no evidence that respondents were considering whether they should express their real feelings to the interviewer. Interviewee comments on this issue are reproduced in Appendix C.

- (9) What types of common phrases might be used in a questionnaire to help recall memories of being startled? Respondents sometimes described their feelings without indicating whether or not there was an involuntary physical movement because of the boom. Respondents used such words as "startle", "surprise", "anxiety", "catch you off guard", "scare", and "jolt". The quite common description, "makes you jump", is ambiguous because it can be used in a figurative sense, but if taken literally, would refer to a physical response. A number of respondents clearly described a physical response: "dropped a coke", "spilled water", slipped "on steps". Respondents' comments are listed in Appendix C.

3.1.2 Issues Not Successfully Addressed

The fact that the frequency of sonic boom flights had always been low in the study regions and that they had disappeared or become extremely infrequent during the last year meant that accurate information could not be obtained about the three following issues:

- (10) For the activity interference questions is there any indication that the frequency-of-occurrence questions may constrain answers on the degree-of-annoyance questions?
- (11) Can respondents easily understand complex questions about the proportion of audible booms which have certain characteristics?
- (12) Did respondents have clear descriptions of adaptation to sonic booms? Several respondents reported one type of change in their reactions. When these respondents first heard a boom they were left with some anxiety about whether some serious explosion might have occurred. Later they learned to more quickly identify sonic booms. It is not clear whether this affected startle reactions.

The questioning was conducted almost entirely in small towns or in rural areas in which residential locations and work locations were not widely separated. In this situation no useful information was gathered on a final topic:

- (13) Is there any indication that conventional questions about a neighborhood could be interpreted differently for a sonic boom which might affect a much larger area?

3.2 Findings Concerning Community Response

The discussion of results is partitioned into demographic characteristics of the sample, perceptions of the sonic boom phenomenon and its frequency, recall of past sonic boom experiences, and the effects of sonic booms on the sample of respondents. Sonic boom effects are further divided into startle reactions, activity interference, physical manifestations, and other reactions. Question numbers are preceded with a "Q".

3.2.1 Demographics of the Sample

Of the 45 interviewees in Utah and Idaho, 35 had lived in their community for over 14 years, indicating little mobility (Q5). The average number of people in each household approached three (Q24). Table 4 gives the occupations of the respondents in each region. In both regions, retired people formed a significant portion of the sample. In Utah, the next largest group was managers and supervisors, whereas the next largest group in Idaho was working in logging and forestry. In both regions, at least half of the sample was away from home no more than 10 hours a week (Q23). Three quarters of the two groups were away 20 hours or less, indicating that the majority of individuals would usually be present in the community during a sonic boom event.

If a person does not work in the community associated with a sonic boom, the boom is unlikely to generate much concern. Therefore, a few questions were added to the Idaho version to probe this issue. Responses to these questions indicated that only three respondents in the Idaho region did not work nearby in the community. The remainder either worked in the community or were retired or disabled, thus suggesting a high probability of exposure to a sonic boom in their community. Several of the people had worked in the area for a long time.

Initial interviews in Utah raised the possibility of sonic boom effects being partly determined by whether the boom was experienced indoors or outdoors. It could be argued that a person may be more likely to notice a boom outdoors. Alternatively, a person may be quite likely to notice a boom indoors, if the building contents rattle or shake. Thus, a subsequent version of the survey (IV) attempted to assess how much time a respondent spent indoors vs outdoors. Individuals responding to this question (Q5d1) indicated that they were outdoors about half of the time. A different version of this item (Q5d2), included in subsequent surveys, developed a more specific quantitative estimate for this variable. This estimate indicated a tendency to spend seven to eight hours a day outdoors. Although this is a rather long time, such a result was obtained in the Idaho region, where there was a high proportion of outdoor activities, such as logging and forestry work.

TABLE 4
OCCUPATIONS OF RESPONDENTS

UTAH		IDAHO/WASHINGTON	
Retired	9	Logging/Forestry	6
Mgr/Supervisor	5	Retired	6
Housewife	3	Housewife	2
County Clerk/ Assistant	1	Carpenter	2
Power Plant Operator	1	Nurse/EMT	2
Turkey Farm Staff	1	Outfitter (Wilderness)	1
Baptist Minister	1	Motel Mgr.	1
Garage Business	1	Trucking Bus. (Owner)	1
		Applied Physicist	1
		Self Employed	1
<hr/> 22		<hr/> 23	

3.2.2 Awareness and Prominence of Sonic Booms

Toward the beginning of the questionnaire a series of items (Q6-Q8) was sequenced to gradually elicit the significance of sonic booms to the respondent. Through a series of open-ended questions, the survey initially requested both positive and negative comments about the local environment, presenting an opportunity for respondents to offer spontaneous comments concerning sonic booms. Then the questionnaire narrowed the environmental focus to a general question about noise. This was followed by a structured group of items, including a specific reference to sonic booms. Then, in the event that this reference was not sufficient, the question was reworded to provide another opportunity for respondents to mention the booms.

No comments about sonic booms were offered when given the opportunity to list disadvantages in the environment (Q7). Only two people considered noise in general important enough to mention. When the question asked only about noise, however, five people in the total sample volunteered sonic booms as the main noise in their area. Approximately half of the people considered traffic as the predominant noise source. The next question (Q8b) specifically asked whether certain noises (e.g., planes, trains, cars, yard tools and helicopters, as well as sonic booms) were heard at home or at work. Whereas the prior questions resulted in few comments about sonic booms, all but two people in the total sample indicated hearing the booms when asked specifically about them.

When noise sources were ranked according to the number of respondents who heard that noise, sonic booms ranked first, followed by road traffic. Helicopters, jets and other airplanes were reported by about half as many people, about on par with trains and yard equipment. Very few respondents in either region reported "other explosions, or bangs and booms." Respondents' descriptions of sonic booms centered on an intense, short-term auditory experience (e.g., a big bang, like a door slamming, explosion, thunder, or loud percussion) (see Appendix C). This concurrence among respondents on a verbal description, plus their agreement that "sonic boom" is the preferred and probably only term for this phenomenon (Q8viiib), suggests that respondents accurately recognize sonic boom occurrences.

Ratings were taken of how much a respondent was bothered or annoyed by sonic boom experiences. Average sonic boom ratings (Q8) were between "a little annoyed" and "moderately annoyed" in both Utah and Idaho. There was no difference in the average annoyance ratings for cars and booms in Utah. Idaho ratings for cars were somewhat lower than for booms, however. In both regions, ratings for jet aircraft, other airplanes, helicopters, trains and yard equipment were generally lower than ratings for sonic booms. These other sources were rated between "a little annoyed" and "not at all annoyed". Although the average rating for all of the noise sources was relatively low, there was considerable variability among possible ratings for sonic booms, especially in Idaho. Of the 20

respondents that answered this question, 8 people were "very annoyed" and 8 people were "not at all annoyed". Although respondents indicated fair agreement in their description of the boom, they evaluated its annoyance differently. Variability among annoyance responses was also present in the Utah sample, but to a lesser degree.

The Utah version of the questionnaire employed a verbal rating for the annoyance from cars, booms, trains, etc., but also employed numerical ratings for the annoyance from cars and booms. In this case, cars received an average rating of 1.0, indicating low annoyance, whereas sonic booms received a higher annoyance rating of 2.2 (Q9, Q10). This outcome suggests a difference in annoyance between cars and sonic booms in contrast to the verbal ratings given earlier. Variations in method may partly account for this difference. First, the numerical rating item for cars used the term "disturbed", in addition to "annoyed" and "bothered", thus possibly introducing a different meaning. Second, the mid level numerical rating categories in the question were not associated with specific meanings. Third, the questionnaire items (Q9 and Q10) which focused on booms, followed an item in which booms received less attention (Q8).

3.2.3 Recall of Sonic Boom Occurrences

One item in the first version of the questionnaire (Q12) asked, "When did you last hear a sonic boom?" Responses in Utah varied from less than a month ago to two years ago. Two people could not remember the last occurrence. About half of the individuals reported a boom about a month ago or less, even though the booms had presumably halted about six months before the interview. When subsequent respondents were asked if they noticed a change in boom frequency (Q12), the majority indicated "Yes". When respondents were asked "When did you notice the change?", answers ranged from about a month ago to in the last five years. This question was changed to "When do you think the change occurred?" for respondents in Idaho. Responses to this question ranged from in the last twelve months to eight to ten years ago.

Although estimates of earlier boom frequencies (Q12d) varied from daily to yearly, about half of the sample indicated at least a weekly occurrence. From a somewhat smaller sample, estimates of current frequencies (Q12b) centered around a monthly frequency. Thus, several people still perceived a continuing boom phenomenon, although on a less frequent basis. These data suggest that memories of sonic boom phenomena were highly variable as concerns recall of sonic boom frequency as well as changes in frequency. Even though sonic booms were supposed to have ceased about 6 months earlier, there were several reports of booms occurring within the last few weeks and even the last few days. This result might suggest an expectation of booms based on an established history of exposure. Also suggested by these data are individual differences in the manner of adjusting to the reduction or removal of sonic booms from the environment. Some persons, not realizing that the

booms have stopped, may believe that they are successful in adapting to the booms. Such variability in the perception of sonic boom frequency may contribute, to some degree, to variability in boom annoyance ratings, as discussed above (Q8). Alternatively, supersonic overflights other than the SR71 may have occurred and may still be occurring in the region.

3.2.4 Startle Reactions to Sonic Booms

In response to the question "Have the sonic booms ever surprised or startled you?"(Q11), almost all of the respondents answered "Yes". A few respondents from Idaho answered "No". Those who answered "Yes" to this question were next asked "What happened then?". Many of the respondents reported a startle effect. For example, they jumped up to see what was going on or their children began to cry. A few people reported observing a physical manifestation, such as the windows rattling or the house shaking. However, one important difference between the two regions was observed with regard to this question. On the one hand, almost half of the Idaho respondents volunteered that they were not bothered by the boom or by the fact that they had been startled. On the other hand, none of the respondents in Utah volunteered not being bothered by the boom.

When asked "What is the worst thing that has ever happened when a boom surprised or startled you?"(Q11a), most of the respondents reported that "nothing" happened or that some type of startle effect occurred. Few of the respondents reported a physical manifestation or accident. When asked "How did you feel when that happened?"(Q11b), most people reported feeling "scared" or "startled", or "mad" or "angry".

Question 11c was designed to assess the degree to which the booms caused some type of physical reaction in the respondents. Specifically, respondents were asked "Has a sonic boom ever startled you so much that you made a jerky movement?" or "... it made your heart beat faster or left you feeling a bit weak?" For both questions, almost twice as many respondents in Utah answered "Yes" in comparison to respondents in Idaho. Of those respondents who answered "Yes" to these questions, most tended to feel a "a little" to "moderately" bothered or annoyed about having these physical reactions. Responses concerning the frequency of physical reactions to the sonic booms were evenly distributed between "sometimes" and "almost everytime" for both regions. These findings indicate that, while almost all of the respondents were surprised or startled by the sonic booms, the likelihood of having a physical reaction to the booms was twice as great for people in Utah. Responses to the question "Did the sonic booms from jets ever startle or frighten you or anyone else in your family"(13ii), also revealed a sizeable difference between the regions. Again, almost twice as many respondents in Utah answered "Yes" to this question, in comparison to the respondents in Idaho. In addition, a larger proportion of respondents in Utah reported being startled "very often" in comparison to respondents in Idaho.

3.2.5 Activity Interference by Sonic Booms

Other questions in the survey addressed the issue of booms interfering with specific activities (Q.13C, i, iii, v, vi). In some ways, activity interference is similar to startle effects in that a normal routine is interrupted due to a sudden intrusion. Specifically, respondents were asked if the booms had ever interfered with their family's radio or TV, sleep, rest, relaxation, or conversation. Only one respondent from Utah said that his/her radio or TV was interfered with by sonic booms. Similarly, only two respondents from Idaho said that their family's rest or relaxation was interfered with by sonic booms. Only half of the Utah respondents and one third of the Idaho respondents said that their family's sleep was disturbed by the booms. Those respondents who said their family's sleep was disturbed tended to rate the frequency of this disturbance as "fairly often" and their degree of annoyance as "moderate". However, twice as many respondents in Utah said that the booms interfered with their conversation as did in Idaho.

3.2.6 Physical Manifestations of Sonic Booms

The survey inquired about the effects of sonic booms on the house and its contents. The topic was initiated with an open question asking about whether things vibrated or shook or rattled during a boom and, if so, which items (Q13, Q15). A high proportion of people reported such an occurrence and listed the entire house, windows, dishes, pictures, and knick-knacks as being affected. The question then followed up with item-specific inquiries about the presence and frequency of rattling, as well as annoyance ratings. The questions were directed to windows, floor, dishes, mirrors, furniture, T.V., and pictures. Most of the respondents reported their house and their windows rattling after a boom. In addition, some respondents reported that their dishes, mirrors, and pictures rattled. There were few reports of floor vibrations and virtually no reports of other rattling objects. The respondents estimated that at least half of the booms resulted in the rattling or shaking of objects. Windows were rated as being more susceptible to the booms (Q15). Average annoyance ratings for these occurrences ranged between "a little annoyed" and "moderately annoyed".

About a quarter of the respondents associated sonic booms with damage to their house such as cracks in the ceiling, wall, chimney, foundation or thermopane window seals (Q16). This damage was thought to have occurred anywhere from two to twenty years ago. Estimates of certainty that the damage was due to sonic booms ranged between "moderately uncertain" to "moderately certain". About a quarter of the people also thought that sonic booms might make a house unsafe or weaken it, by breaking a window or skylight, by damaging the foundation walls, or in one case, by loosening boulders on a steep hill close behind the house (Q17a, b). Average estimates of certainty for these possibilities again ranged from "moderately uncertain" to "moderately certain".

A slightly smaller proportion of people had heard neighbors say that a boom could make a house unsafe or weakened (Q19). Only three people from the total sample had considered the possibility that a supersonic aircraft might crash in their neighborhood (Q19).

3.2.7 Somatic Perception of Sonic Booms

In addition to hearing sonic booms and seeing the shaking of objects that they cause, some individuals may sense the booms with their bodies. When respondents were asked if they could feel the boom itself, without feeling anything else moving or without noticing any other visible manifestations, half of the people said that they could feel the boom. On the average, "little" to "moderate" annoyance was reported from such somatic perception of sonic booms. The respondents estimated feeling about half of the booms that they heard.

3.2.8 Impact of Sonic Booms on Animals

Some animals appear to be affected by sonic booms. More than half of the total respondents owned animals, with the Idaho sample having a considerably larger proportion of animal owners (Q.20). Dogs, cats, birds and cows were common to both regions. Almost half of the owners reported that their animals were disturbed. For instance, dogs are apparently frightened and try to escape from the noise. Other reports of animal responses to sonic booms included birds being startled or quieting for an hour, cows running around in the corral, calves hopping up and down, elk running away, and a cat going up to the door to investigate. Only one person reported losing money due to a sonic boom-related effect on animals. This occurred in California when an owner lost a mink after a sonic boom frightened a parent mink, which subsequently killed and ate its young.

3.2.9 Complaints Concerning Sonic Booms

Only eight people in the entire sample reported that sonic booms were an issue in their community. Twenty-nine people stated that they were not an issue. A few questions addressed possible overt actions in response to the sonic boom issue. Only one person from the entire sample made an effort to contact someone knowledgeable about sonic booms, in this case an Air Force officer (Q21). Most respondents felt that people should complain about the booms if they were annoyed (Q22). Those respondents who felt that people should not complain gave reasons of national defense or insignificance compared to other issues.

4.0 Discussion

4.1 Factors in Preparing a Final Questionnaire

The questionnaire which is proposed in the present report has been developed for general use to meet the goals specified in Section 1.4. The relationship between the study goals and the

individual interview questions was outlined in Appendix A. The specific form of a final questionnaire would need to be adapted to the unique conditions of a particular study. This section outlines some of the factors which should be considered in finalizing the proposed questionnaire for application in an actual full-scale social survey.

4.1.1 Adaptation to Local Community Conditions

At least three aspects of the local community could lead to additions or modifications to the questionnaire:

- (1) Local noise environment. If there are other significant sources of noise in the local area they should be directly addressed in the questionnaire. This is especially important for other sources of aircraft noise. Allowing respondents to talk about other, potentially more important, aircraft noise problems allows, at the very least, for respondents to feel that the questionnaire is responsive to their concerns. If the sonic booms may be confused with other local aircraft noise, clear distinctions need to be drawn by asking about other flights. Low level military flights should be specifically mentioned if they are expected to be present in an area. If there are other important local impulsive noises present, these noise sources should be mentioned in the questionnaire. This is especially important if these other noise sources could be a source of danger and possibly be confused with sonic booms.

The present questionnaire has been designed on the assumption that noise levels from other types of aircraft and transportation noise will not be measured with sufficient accuracy to be studied in terms of a dose/response relationship. If a range of other aircraft noise is also present, the sonic boom questionnaire should be adapted to permit a direct comparison of the dose/response relationships for sonic booms and local conventional aircraft noise.

- (2) Community relations. The present questionnaire was developed for the case where there are no local ties to the noise source and the purpose of the sonic boom flights is not clear. If any community residents are employed by organizations closely related to the noise source, this fact should be ascertained in the questionnaire. If the flights are clearly identified as military flights, especially military flights with a particular mission, then at least one source-related attitudinal question should be included. If there is a history of community complaints or community organization against noise, then the respondent's relationship to such activities should be determined.

- (3) Flight operation issues. If operational options for the timing or location of flights are being considered, appropriate relevant questionnaire items might increase the value of the survey. These items could either take the form of direct evaluations of alternative operations, or of less direct questions about noise impact under relevant conditions. For example, nighttime annoyance might be explored in more depth if the timing of nighttime flights were an important operational decision. If it is important to know whether some flights are more annoying than others, then precise questions would be needed to identify the timing and characteristics of those annoying flights.

4.1.2 Adaptation to Survey Administration Conditions

Details of the survey administration could also necessitate additions or modifications to the questionnaire:

- (1) Respondent selection within households. Questions and introductory procedures should be developed to ensure that there is random selection of respondents within households.
- (2) Adaptation to telephone administration. If the interviews are conducted by telephone then alternatives to show cards should be tested. Respondents might be mailed a pre-interview letter which could increase participation and include a general purpose rating scale that the respondent could keep by the telephone. Alternatively, respondents might be asked to write the standard verbal scale labels on a piece of paper at the start of the interview.
- (3) Further Pretesting. A final questionnaire should be tested in a moderate-sized, standardized pilot test. This provides a test for any new questions as well as a full scale test for the completed draft questionnaire.
- (4) Adaptation to study comparison goals. The proposed questionnaire includes questions to facilitate three comparisons. Activity interference questions provide a direct linkage to the Oklahoma City study, the most useful previous sonic boom study. A four-point, verbal annoyance scale question provides a linkage to the largest number of conventional aircraft noise studies, especially in England. An 11-point, numeric scale provides a direct linkage to the Toronto aircraft noise survey which studied indoor/outdoor annoyance differences (Taylor, Hall and Birnie, 1980). If other study populations or objectives became important, then the possibility of additional questions might be considered. The largest-scale United States aircraft noise study used a five-point, numeric scale (Connor and Patterson, 1972). A number of recent studies around small United States airports have used five-point, verbal scales (Fidell et al., 1985). The most recent large-scale, multi-airport survey was

conducted in Australia, using a different five-point, verbal scale (Bullen, Hede and Kyriacos, 1986).

A consistent basis for comparison requires that respondents be asked pairs of questions about the same sound. Some of this information could be extracted from reanalyses of existing surveys which contain more than one scale. Other comparisons would require new data collection, which might be conducted in either a laboratory or a community setting. Planning for such comparisons would require consideration of such issues as the feasibility of telephone administration, effects of question order, and the interaction among different types of questions within the same data collection program.

- (5) Issues which were ignored in the questionnaire. Sonic boom studies have covered a wide range of issues. Many of the questionnaires have been longer than the present one. At the present time it does not seem to be important to address all of the possible issues associated with sonic booms. Some of the major issues which were not discussed above are:

Projected reactions to hypothetical situations in which there would be more booms.

- Annoyance with other non-noise problems in the area.
- Overall rating of the area as a place to live.
- Overall rating of the noisiness of the area.
- Knowledge about the flights which produce the sonic booms.
- Beliefs about whether manufacturers, operators, or other authorities could reduce the sonic booms. (This is usually labeled a "preventability" or a "malfeasance" attitude.)
- The respondent's self report of general sensitivity to noise.
- Feelings about whether respondents would like to complain (The current questionnaire only asks about actual complaints and whether other people should complain).
- Plans for moving and feelings about moving away from the area.
- A clearer "acceptability" measure such as "could you get used to the booms" or "are the booms simply unacceptable"?

- Reported changes in the respondent's adaptation to the sonic booms.
- Beliefs about the efficacy of complaining.
- More detailed demographic questions on education, income, occupation, home ownership, type of dwelling, etc.
- Frequency of air travel.

4.2 Factors in Interpreting the Pretest Results

The present questionnaire pretest also produced some preliminary results regarding residents' reactions to sonic booms in the regions surveyed. These preliminary results must be interpreted with considerable caution. First, the retrospective nature of the pretest depended heavily on the respondent's memory. Second, agreement could not always be reached among members of a sampled household. Third, the sample size and survey methodology were suitable for a questionnaire pretest and not for a full-scale survey.

4.2.1 Memory for Sonic Booms

Sonic booms were not uppermost in people's awareness when they were asked to identify things that they did not like about their environment, or to identify the main noises in their community. However, their annoyance ratings for various noises indicated that booms were the most annoying noise source in Utah, and in Idaho, sonic booms vied with traffic noise as the most annoying noise source.

The finding that few people volunteered sonic booms as a noise problem is not consistent with their high ranking of booms in annoyance ratings. It is as if people needed to be reminded that booms were a part of their noise environment. Once reminded, they were able to provide various kinds of information about the booms. If one assumes that the booms had, in fact, stopped several months earlier, this interpretation suggests that the respondents had either forgotten or perhaps repressed their experience of the sonic booms. In support of the forgetting interpretation, there was considerable variability in the ability of respondents to recall the approximate time of the last occurrence of a sonic boom.

If people needed to be reminded about the sonic booms, then it is possible that their annoyance ratings for the booms may have been conservative. Consequently, the respondents may have provided a higher annoyance rating if the booms had been current. Thus, it may be inappropriate to compare annoyance ratings of a current noise source like cars to a past noise source like sonic booms. It is likely that the results for several questions in the current pretest may have been affected in this way.

4.2.2 Agreement Among Family Members

During several interviews, the discussion was joined by another family member or by a friend. In some of these interviews the individuals disagreed on the frequency of the sonic booms. In one case a man said that he wasn't aware of any sonic booms in the area. When the interviewer got ready to leave, the man went to check with his wife. The wife then gave a detailed description of sonic booms that she had experienced, including cracked windows in their house. Further discussion revealed that the husband worked in the logging business a considerable distance away. This kind of observation was not documented. However, if the assumption that household members agree with each other on sonic boom effects is important for future surveys, then it may be useful to explore the above observation further.

4.2.3 Pretest Limitations

Several factors qualify the generalizability of the data obtained from the present questionnaire pretest. The retrospective nature of a questionnaire involving the memory of respondents has already been discussed. The number of people interviewed in the two regions was small, severely restricting statistical reliability. A larger sample of respondents might reduce the response variability associated with certain questions, resulting in more accurate estimates of central tendencies. The interviewees were not selected according to strict criteria. For instance, although people were interviewed on weekdays as well as during the evenings and on weekends, the possibility exists that the survey was biased toward individuals less likely to leave their home, such as the disabled or retired. Individuals who work a full week or more and are heavily involved in family and community activities may have been less accessible for interviews. These individuals might have a different response to the sonic booms. In addition, the survey questionnaire changed multiple times. Reordering of items, as well as changing the wording or phrasing of items, could have affected the perception of the intended question.

5.0 Conclusions

The present study succeeded in developing a community response questionnaire on the effects of sonic booms for possible future use in a full-scale social survey. The methodology resulted in the following achievements:

- Developed a preliminary draft questionnaire that was based on previous research concerning the community response to both conventional jet aircraft noise and sonic booms;
- Incorporated questions that could yield information for a dose/response relationship in future surveys

where physical measurements of actual sonic boom exposures would be made;

- Pretested this preliminary draft questionnaire in two communities by means of informal face-to-face interviews with residents;
- Modified and enhanced the questionnaire instrument both during and after the interviews to incorporate lessons learned from the pretest;
- Analyzed the data from the interviews to estimate the degree of community annoyance experienced in the two regions sampled.

The major methodological conclusions were:

- The term "sonic boom" is the best wording to use for the phenomenon being studied.
- The preliminary draft questionnaire was too repetitious. Therefore most open-ended questions were eliminated from the final proposed survey instrument.
- Attention must be paid to the wording of questions involving the startle reaction so as to separate possible physiological and behavioral responses.
- A retrospective survey that depends upon the respondent's memory is not advisable for determining the timing or frequency of sonic boom occurrences.

The major empirical conclusions were:

- Average sonic boom annoyance ratings for the entire sample of respondents were between "a little annoyed" and "moderately annoyed."
- Recall of sonic boom occurrences was extremely variable and sometimes contradictory. Estimates of sonic boom frequency ranged from once per day to once per year, with once per week being the average response.
- Almost all of the respondents were startled at one time or other by the sonic booms. The degree of annoyance caused by these startle reactions was uncertain.
- Between one-half and one-third of the respondents reported that their sleep had been disturbed by sonic booms. Other activity interference was minimal.
- A high percentage of respondents reported that objects

shook or rattled during a sonic boom. Windows were the most susceptible, but dishes, mirrors and pictures also rattled.

- About a quarter of the respondents associated sonic booms with damage to their homes, such as cracks in the ceiling, walls or window seals. There was considerable variability in the certainty of sonic booms as the cause.
- Animals appear to be affected by sonic booms. Dogs are apparently frightened and attempt to escape from the noise. Reports were recorded of birds, cows, elk and mink being startled.

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APPENDICES

- Appendix A. Relationship of Model Boom
Questionnaire to Study Goals
- Appendix B. Annotated Sonic Boom Questionnaire
- Appendix C. Respondent Comments
- Appendix D. Final Sonic Boom Questionnaire
- Appendix E. Pretest Data Presentation Questionnaire

APPENDIX A: RELATIONSHIP OF MODEL BOOM QUESTIONNAIRE TO STUDY GOALS

Each question in the questionnaire has been developed for a specific purpose. This outline of study goals identifies the questions which relate to each goal.

- GOAL I. Develop dose/response relationships for comparisons to other surveys.
- A. Comparisons to conventional aircraft surveys
 - 1. General sonic boom annoyance
 - (1) 4-point verbal annoyance scale Q8..v
 - (2) 10-point indoor-outdoor question Q24, Q25
 - 2. Volunteered problems Q7 (This provides a relatively weak basis for comparison)
 - B. Comparisons to 1964 Oklahoma City Sonic Boom Study
 - a. Specific activity interference annoyance questions Q10
 - b. Acceptability of complaining (used as screening question in analysis) Q23
- GOAL II. Sources of information about the place of low-frequency energy in the dose/response relationship
- A. Extent of perceptions of vibration-related phenomena
 - 1. Types of items which are perceived to vibrate
 - a. Any vibration Q#12, Q#13, Q#14
 - b. Windows Q#12..i
 - c. Items in house Q#12
 - d. Felt house Q#13
 - 2. Damage
 - a. Any damage Q#16
 - b. Structural damage & assessment of certainty Q#17
 - B. Relative importance of vibration-related phenomena and other aspects of sonic booms
 - 1. Indirect comparison to startle reactions Q#11.f, Q#15
 - 2. Indirect comparison through outdoor/indoor questions
 - a. Relative indoor/outdoor annoyance Q#23, Q#25
 - b. Reasons for differences in indoor/outdoor Q#26
 - 2. Direct comparison Q#27
 - 3. Relative importance of involuntary startle reactions, fear, and annoyance Q#27
- Goal III. Explain sonic boom reactions
- A. Demographic variables
 - 1. Age Q#31
 - 2. Sex (by observation) Q#5
 - B. Exposure to booms
 - 1. Time at home Q#28
 - 2. Years of residence Q#30
 - C. Danger/fear(not startle) associated with sonic booms
 - 1. Fear of aircraft crashing Q#19
 - 2. Concern about health Q#20
 - 3. Other Q#21

- D. Details of startle reactions
 - 1. Extent and types of "startle reactions"
 - a. Frighten/scare Q#11.a
 - b. Muscular movements Q#11.b, Q#11.c
 - c. Adaptation over time Q#11.d
 - d. How many and often experience Q#11.e
- E. Details of respondent's perceptions
 - 1. Perceived frequency of sonic booms Q#9
- F. Other effects
 - 1. Effects on animals Q#18

GOAL IV. General support for survey methods

- A. Sample weighting for household size Q#29
- B. Identification of interviewer Q#2

ENVIRONMENTAL SURVEY

Q1.	Date of interview		<u>(Mo)</u>	<u>(Dy)</u>	<u>(Yr)</u>	
Q2.	Interviewer ID	_____				
Q3.	Questionnaire ID	_____				
Q4.	Time interview starts		<u>(Hr)</u>	<u>(Min)</u>		
					1	AM
					2	PM
Q5.	Sex of respondent	1 MALE				
		2 FEMALE				

COMMENT ##### COMMENT STARTS HERE ##### COMMENT

COMMENT ##### COMMENT ENDS HERE ##### COMMENT

COMMENT ##### COMMENT STARTS HERE ##### COMMENT

***** COMMENT ***** COMMENT ENDS HERE ***** COMMENT *****

Q7. How about any things you particularly dislike about this area, that is things which are disadvantages. What are the one or two things that you dislike the most about this area? (RECORD ALL PHRASES DESCRIBING ENVIRONMENTAL NUISANCES VERBATIM)

***** COMMENT ***** COMMENT STARTS HERE ***** COMMENT *****

Although an attempt should always be made to record verbatim responses, it is especially important that the exact phrases used to describe environmental nuisances be recorded verbatim here. This question is useful for determining whether sonic booms are a highly salient, current, and important issue for the respondent at the present moment. The question also allows respondents to feel that their strongest feelings have been recorded.

***** COMMENT ***** COMMENT ENDS HERE ***** COMMENT *****

Q8. Now I have some questions about noises which you might have heard when you have been at home.

***** COMMENT ***** COMMENT STARTS HERE ***** COMMENT *****

A number of possible open questions on annoying noises were considered. The most likely question was one used by Borsky (Borsky, 1965: Appendix, Q.7. in "Yellow" questionnaire). Such a question was not included for several reasons. Answers were too likely to not be sufficiently specific to enable a respondent to be correctly excluded from the checklist. A person who has not volunteered a noise may not report an annoyance in the checklist because it represents an error of omission in the open question. The initial open question has already provided the opportunity to volunteer a problem.

***** COMMENT ***** COMMENT ENDS HERE ***** COMMENT *****

a Do you ever hear the noise from(cars or trucks on a street or highway)... when you are at home?

***** COMMENT ***** COMMENT STARTS HERE ***** COMMENT *****

This final check list eliminated three alternatives which appeared in the first interviews:

1. "Trains"
2. "Any other road traffic"

3. A follow-up question which was designed to elicit sonic boom responses from people who might use some other phrase was eliminated. None of the respondents was found to have any difficulty with the term "sonic booms from jets". The original planned wording and instructions for the follow up question was "[ASK IF SONIC BOOM NOT MENTIONED ABOVE] The sound like an explosion or thunder from the sonic boom the supersonic jets make when they break the sound barrier?"

***** COMMENT ***** COMMENT ENDS HERE ***** COMMENT *****

[COMPLETE a BEFORE STARTING b]

b [ASK FOR EACH SOUND HEARD] Does the noise from ...(MENTIONED SOUND)...bother or annoy you very much, moderately, a little or not at all?

		a. HEARS			b. BOTHERS OR ANNOYS				
		YES	NO	DK	VERY MUCH	MODERATELY	A LITTLE	NOT AT ALL	DK
i.	Cars or trucks on a street or highway	YES	NO	DK	VERY	MOD	LITTLE	NOT	DK
ii.	Motorcycles	YES	NO	DK	VERY	MOD	LITTLE	NOT	DK
iii.	Neighbors' tools or yard equipment	YES	NO	DK	VERY	MOD	LITTLE	NOT	DK
iv.	Helicopters	YES	NO	DK	VERY	MOD	LITTLE	NOT	DK
v.	Sonic booms from jets	YES	NO	DK	VERY	MOD	LITTLE	NOT	DK
vi.	Ordinary jet aircraft	YES	NO	DK	VERY	MOD	LITTLE	NOT	DK
vii.	Any other airplanes (DESCRIBE) _____	YES	NO	DK	VERY	MOD	LITTLE	NOT	DK
viii.	Any other explosions, or bangs or booms? (DESCRIBE) _____	YES	NO	DK	VERY	MOD	LITTLE	NOT	DK
ix.	Any other noises (DESCRIBE) _____	YES	NO	DK	VERY	MOD	LITTLE	NOT	DK

***** COMMENT ***** COMMENT STARTS HERE ***** COMMENT *****

Instructions for questions:

Reading amount of annoyance question: Read all four alternative answers at least three times. If there is a digression or any discussion between items on the checklist, be sure to read all four alternatives again. If the respondent hesitates, reread the four alternatives.

***** COMMENT ***** COMMENT ENDS HERE ***** COMMENT *****

[IF SONIC BOOM IS NOT HEARD, SKIP TO Q28 AT END OF QUESTIONNAIRE]

Q9. How often do you hear the sonic booms from jets here?
[DO NOT READ CODE CATEGORIES]

- 1 LESS OFTEN THAN ONCE A YEAR
- 2 AT LEAST ONCE A YEAR (INCLUDES LESS THAN ONCE A MONTH)
- 3 AT LEAST ONCE A MONTH
- 4 AT LEAST ONCE A WEEK
- 5 AT LEAST ONCE A DAY

***** COMMENT ***** COMMENT STARTS HERE ***** COMMENT *****

This is a suitable location to obtain perception information to determine whether the respondent is referring to the sonic booms which are included in the noise measurement program. The question is not restricted to the last year because the time frame for the next question is broader than the last year.

***** COMMENT ***** COMMENT ENDS HERE ***** COMMENT *****

Now I have a few quick questions about sonic booms. I just need short answers from you now. We will get more details in other questions in a moment.

***** COMMENT ***** COMMENT STARTS HERE ***** COMMENT *****

This introduction will make it somewhat easier to ask more detailed questions later.

***** COMMENT ***** COMMENT ENDS HERE ***** COMMENT *****

- Q10. a Do the sonic booms from jets ever...(READ EACH ITEM).....? [CONTINUE WITH b AND c]
- b. [ASK FOR EACH INTERFERENCE] How often does that happen? Does it happen very often, fairly often, or only occasionally?
- c. When it happens does it make you feel very annoyed, moderately annoyed, only a little annoyed or not at all annoyed?

	a. OCCUR			b. HOW OFTEN				c. HOW ANNOYED			
	YES	NO	DK	VERY OFTEN	FAIRLY OFTEN	ONLY OCCASIONALLY	DK	VERY MODERATELY	ONLY A LITTLE	NOT AT ALL	DK
i. Interfere with your radio or TV	YES	NO	DK	VERY	FAIRLY	OCCAS	DK	VERY MOD	LITTLE	NOT	DK
ii. Startle or frighten anyone in your family	YES	NO	DK	VERY	FAIRLY	OCCAS	DK	VERY MOD	LITTLE	NOT	DK
iii. Disturb your family's sleep	YES	NO	DK	VERY	FAIRLY	OCCAS	DK	VERY MOD	LITTLE	NOT	DK
iv. Make your house rattle or shake	YES	NO	DK	VERY	FAIRLY	OCCAS	DK	VERY MOD	LITTLE	NOT	DK
v. Interfere with your family's rest or relaxation	YES	NO	DK	VERY	FAIRLY	OCCAS	DK	VERY MOD	LITTLE	NOT	DK
vi. Interfere with your conversation	YES	NO	DK	VERY	FAIRLY	OCCAS	DK	VERY MOD	LITTLE	NOT	DK

***** COMMENT ***** COMMENT STARTS HERE ***** COMMENT *****

These activity interference questions were used in the Oklahoma City study. They are the only results from that survey which were reported by noise level. They need to be asked exactly as written. The call back surveys in the Oklahoma City Study dropped the frequency part of the question. By repeating all these questions it will be possible to estimate the proportion of the Oklahoma City residents who would have rated themselves as annoyed on the more conventional scales which are included in the present survey.

The call back surveys in the Oklahoma City Study dropped the frequency part of this question. It is recommended that half the respondents should answer the full question and half should not be asked the frequency part of the question. If the sample exceeds 500, the possibility of not asking these questions of part of the sample should be considered.

***** COMMENT ***** COMMENT ENDS HERE ***** COMMENT *****

The rest of these questions are about only your own experiences.

Q11. Have the sonic booms ever surprised or startled you?

1. YES
2. NO (SKIP TO Q12, NEXT PAGE)

a. Have the sonic booms only surprised you or have they actually frightened or scared you?

1. ONLY SURPRISED
2. FRIGHTENED/SCARED

b. Has a sonic boom ever startled you so much that you made a jerky movement?

1. YES
2. NO

c. Has a sonic boom ever made you drop something or fall?

1. YES
2. NO

d. When have you been the most startled or surprised by sonic booms? Were you the most startled when you first heard them, are you most startled now, or has it always been about the same?

1. AT FIRST
2. NOW
3. ALWAYS SAME

e. In just the last 12 months, how often, if at all, have you been startled or surprised by a sonic boom? Have you been startled or surprised at least once a week, at least once a month, at least one time, or have you not been startled or surprised even once in the past 12 months?

1. WEEKLY
2. MONTHLY (12+ TIMES)
4. AT LEAST ONCE (1 TO 11)
5. NONE (IN THIS YEAR)

***** COMMENT ***** COMMENT STARTS HERE ***** COMMENT *****

The previous question sequence primarily serves to determine whether the person is only reporting initial experiences or is continuing to be startled.

***** COMMENT ***** COMMENT ENDS HERE ***** COMMENT *****

f. Now, to sum up you feelings about being startled or surprised by sonic booms, would you say that being startled or surprised makes you feel very annoyed, moderately annoyed, a little annoyed or not at all annoyed?

1. VERY
2. MODERATELY
3. A LITTLE
4. NOT AT ALL

The next questions ask about whether you have noticed different things vibrating or rattling or shaking or ever felt anything when there has been a sonic boom.

Q12. When you have heard a sonic boom, have you ever noticed ...(windows rattle or shake)...? [CONTINUE WITH ii)

	YES	NO	DON'T KNOW
i. windows rattle or shake	1. YES	2. NO	3. DK
ii. pictures or mirrors or decorations, or dishes or other things on shelves or the wall rattle or move	1. YES	2. NO	3. DK

Q13. Have you ever actually felt the furniture or the floor or the house vibrate?

1. YES 2. NO

[ASK IF NO TYPE OF VIBRATION MENTIONED IN Q.12 OR Q.13]

Q14. Have the sonic booms ever made anything in your house rattle or shake or vibrate?

1. YES (CONTINUE) 2. NO (SKIP TO Q16, NEXT PAGE)

Q15. Now, to sum up your feelings about the vibrations, would you say that the rattling or shaking or vibrating makes you very annoyed, moderately annoyed, a little annoyed or not at all annoyed?

1. VERY
2. MODERATELY
3. A LITTLE
4. NOT AT ALL

ASK ALL

Q16.a Now consider any things that have broken or been damaged around your home in the last few years. Have you ever thought that the booms might have had anything to do with any of these things being broken or damaged?

1. YES ☐

2. NO (SKIP TO Q17)

b What things do you think might have been broken or damaged by the boom? (RECORD DESCRIPTION OF ITEM AND DAMAGE IN GRID BELOW.)

c About what month and year was it when you noticed that damage? (ENTER DATE)

[COMPLETE b AND c BEFORE ASKING d]

d We would like to know how certain you are about what caused the damage. For the(DAMAGE, ITEM)... are you very certain, moderately certain, moderately uncertain or very uncertain that the damage was caused by the sonic boom?

b.		c. DATE		d.			
ITEM	DAMAGE	YEAR	MONTH	VERY CERTAIN	MODERATELY CERTAIN	MODERATELY UNCERTAIN	VERY UNCERTAIN
i.				1	2	3	4
ii.				1	2	3	4
iii.				1	2	3	4

Q17. Have you ever thought that the booms might make your house unsafe?

1. YES!!

2. NO [GO TO NEXT QUESTION]

a. How certain or uncertain are you about whether the sonic booms could make your house unsafe: very certain, moderately certain, moderately uncertain or very uncertain?

1. VERY CERTAIN
2. MODERATELY CERTAIN
3. MODERATELY UNCERTAIN
4. VERY UNCERTAIN

***** COMMENT ***** COMMENT STARTS HERE ***** COMMENT *****

These could be very sensitive questions from a policy maker's perspective. However, it is important to know whether these are major factors for residents. The engineers say that there is good strong evidence that there is no reason to fear significant structural damage. If people really are fearful of the damage, then a frank informational campaign might be useful. Some information is gathered here to be sure that we are not suggesting new ideas to people.

If necessary, this section could be prefaced or followed by a statement or information about there not being any possibility of damage.

***** COMMENT ***** COMMENT ENDS HERE ***** COMMENT *****

Q18. Do you have any animals or livestock or any types of pets?

1. YES!! 2. NO [SKIP TO Q19]

a. What types of animals are they?

b. Have they been disturbed by the sonic booms, or not, or do you not know?

1. YES!! 2. NO [SKIP TO Q19] 3 DON'T KNOW [SKIP TO Q19]

c. What do you notice about them when they are disturbed?

d. Have you ever lost any money or had to spend any money because the animals were disturbed by the sonic booms?

1. YES-- [PROBE IF NECESSARY "How did that happen? Which animals were those?"]

2. NO

***** COMMENT ***** COMMENT STARTS HERE ***** COMMENT *****

This is a simple attempt to obtain some indication of the number of people who feel that they have sustained some economic losses from the effect of sonic booms on animals.

***** COMMENT ***** COMMENT ENDS HERE ***** COMMENT *****

Q19. Do you ever feel there is any danger that one of the supersonic aircraft might crash nearby?

1. YES!!!

2. NO [SKIP TO Q20]

- a. Would you say you feel this: very often, moderately often, or only occasionally?
1. VERY OFTEN
 2. MODERATELY OFTEN
 3. ONLY OCCASIONALLY

***** COMMENT ***** COMMENT STARTS HERE ***** COMMENT *****

This is the same as in the 1967 Heathrow survey (MIL, 1971) and British Railway survey, (Fields and Walker, 1982) except that it does not specify "when you hear the aircraft fly overhead". By the time they hear the boom, they would be expected to realize that the aircraft could not crash at their house. Other surveys use different wordings for fear questions.

***** COMMENT ***** COMMENT ENDS HERE ***** COMMENT *****

Q20. Would you say that the sonic booms have any effect on your health?

1. YES!!

2. NO (SKIP TO NEXT QUESTION)

***** COMMENT ***** COMMENT STARTS HERE ***** COMMENT *****

The closed part of this question comes from the 1967 Heathrow survey (MIL, 1971).

***** COMMENT ***** COMMENT ENDS HERE ***** COMMENT *****

a. How do they affect your health? (DESCRIBE)

Q21. Do you think that the sonic booms are a danger for you in any other way?

1. YES!!

2. NO (SKIP TO NEXT QUESTION)

a. What is it that is dangerous? (DESCRIBE)

Q22. Have you, yourself ever done anything about the booms like writing or visiting or telephoning an official or someone else to complain about them?

1. YES|| 2.NO [SKIP TO Q23]

a. What did you do?

b. [IF NECESSARY] Who did you contact?

***** COMMENT ***** COMMENT STARTS HERE ***** COMMENT *****

This provides simple information about whether action has been taken. The Oklahoma City question is longer and covers both feeling about wanting to take action as well as whether anyone in the family had taken action. If a particular organization is active in an area, then more specific questions might be framed. The question is not to be used to define a dose-response relationship, but rather to obtain some indication of the level of complaint activity.

***** COMMENT ***** COMMENT ENDS HERE ***** COMMENT *****

Q23. Do you think people around here should complain about these booms if they find them annoying?

- 1 YES
2 NO
3 DON'T KNOW

***** COMMENT ***** COMMENT STARTS HERE ***** COMMENT *****

This question comes from the Oklahoma City questionnaire (Question 22 in Borsky, 1965). The question was used as a filter in the analysis but appeared after virtually all of the annoyance questions in the questionnaire.

***** COMMENT ***** COMMENT ENDS HERE ***** COMMENT *****

Q24. Now we will ask you to rate the sonic booms, but this time using a number from zero to 10. Zero means "not at all disturbed" and 10 means "unbearably disturbed". During the daytime when you are here at home how would you compare the sonic booms inside and outside the house?

First how would you rate the sonic boom when you are inside your house? Choose zero if you are not at all disturbed, 10 you are unbearably disturbed and a number from 1 to 9 if you are somewhere in between.

_____ Number

Q25. Now how would you rate the sonic boom when you are outside your house here?

(REPEAT IF NECESSARY...Choose zero if you are not at all disturbed, 10 if you are unbearably disturbed and a number from 1 to 9 if you are somewhere in between.)

_____ Number

[ASK IF RATINGS ARE NOT THE SAME]

Q26. So you feel the booms are worse (...inside/outside....) the house. Why are they worse for you there?

[DO NOT PROMPT. CIRCLE PRECODE IF OFFERED, RECORD VERBATIM IF OTHER]

	<u>Mentioned as worst</u>	<u>Not mentioned</u>
VIBRATION, RATTLE, SHAKE	1	0
STARTLE, SURPRISE	1	0
NOISIER, LOUDER (GENERALLY)	1	0
OTHER (Describe) _____	1	0

***** COMMENT ***** COMMENT STARTS HERE ***** COMMENT *****

These two questions use the 11-point scale from the Toronto aircraft/road traffic survey. (Taylor, Hall and Birnie, 1980) The questions provide a comparison to a conventional aircraft survey as well as a basis for an inside/outside comparison which could give important insight into the effect of vibration. On the exploratory interviews respondents seemed to easily use a numerical scale for rating noise with out show cards.

This particular question was not used in any of the developmental interviews. The standard pretest should examine this question carefully. Special attention needs to be given to the quality of the interviewer's coding of the open response. For example if a respondent mentions both good and bad points about one location, the interviewer must only code the points which refer to the worst of the two locations (ie. inside or outside) even if the respondent describes the better location in answering the question.

***** COMMENT ***** COMMENT ENDS HERE ***** COMMENT *****

Q27. We have asked about several ways that sonic booms can affect people. Now to sum it up, for you personally what is the single most disturbing thing about the sonic booms: is it the vibration and rattle, or the surprise and startle, or the loudness of the booms, or is it something else?

1. VIBRATION, RATTLE
2. STARTLE, SURPRISE
3. LOUDNESS
4. OTHER (DESCRIBE)

Now I have a few last background questions

Q28. How much of the time do you spend within about ten miles around here and how much of the time are you further away. In an average week, about how many hours are you at least ten miles away from your home?

COMMENT ##### COMMENT STARTS HERE ##### COMMENT

"Ten miles" has been rather arbitrarily entered here. If some other distance or location could be used to specify daytime exposure location, then something else should be substituted.

COMMENT ##### COMMENT ENDS HERE ##### COMMENT

(HOURS)

Q29. Including yourself, how many adults, that is people over 18, live in your household?

(NUMBER)

Q30. When did you move to this address? _____
(MO) (YR)

COMMENT ##### COMMENT STARTS HERE ##### COMMENT

This should be more accurate than length of time at residence. For some types of surveys where it would serve as a filter question, the question would need to appear early in the questionnaire.

COMMENT ##### COMMENT ENDS HERE ##### COMMENT

Q31. What year were you born? _____

APPENDIX C: RESPONDENT COMMENTS

After interviewing was completed, the questionnaires were examined and respondent comments were extracted on specific topics. These provide a guide to the types of vocabulary respondents used during the interview.

Descriptions of the sound of a sonic boom

(Many of these comments were in response to the interviewer's request to describe the boom.)

Respond- ent ID#	Comment
10	Like something hit the house. You get a "pop" or something. Like a door slamming.
13	Sounds like big bang
14	A blast. They are startling not annoying
15	Big blast in road construction
16	Loud bang... like the furnace exploding across the street at school
17	Just a boom like an explosion..little vibration
18	Like an explosion... "a loud boom"
2	Like when Richland refinery blew up and windows suck in and out
2	Reminds us of going to 4th of July and seeing big white flash then: boom, boom.
20	Sounds like an explosion, dynamite blast
22	Even children call it a sonic boom. Compression of air waves, shakes ground
23	Thunderous noise, windows flap. Often a pop-pop.
3	Explosion
5	Hear loud bang. Always hear the plane after the bang
6	It's just a hellishly loud boom
7	Double shock if closer- can hear it -single shock
9	Loud percussion, hollow sound followed by jet sound
c	Explosion of sound. (It is)... one sound aware of. Startles. Rattles windows
g	Sounds like a bomb
i	Loud boom like a firework
k	Sometimes a crack-crack
o	Like thunder. Like if lightening hit your dooryard. Hate it
s	Loud clap or noise something like thunder
u	Like mild earthquake
v	Big bang that shakes windows
l	Very loud bang noise

Descriptions of directly experiencing low frequencies though body vibrations

(Many of these comments were in response to the interviewer's request to describe feeling the boom without noticing other things vibrating.)

Respond-
ent

ID#	Comment
1	"Pressure on you", like someone shot an air can near you
11	Seems like you can feel it in the air
12	Feels like you feel a thud
13	Felt like concussion...chair jumps up and down when sitting down
2	Gave us a good jolt. Very disturbing when out in woods
2	Like when you pop your ears..pressure
21	When outside like stick of dynamite, not ground shake but shakes body
4	You can feel them with your whole body, like a shock wave
7	Being too close to a fire cracker. Its a sharp pressure. Its not a breeze. Sharp rap.
9	It's just a vibration
c	Feel pressure outside, not inside
c	Boom has a feeling that is different, not like fireworks
k	Shock wave like a change in pressure. Less than dynamite. More than wind when someone goes past you
c	There is a definite feeling almost like momentary pressure feeling

Descriptions of startle responses

Respond-
ent

ID#	Comment
1	Surprise, anxiety from the boom
1	Slightly elevate heart beat
10	Take you by surprise. It's just startle.
11	They make you jump
19	Startled in the past, not any more. Take things as they come. Try not to let anything upset
2	Heart skipped,
2	Catches you off guard. Startled, surprised. So infrequent you never know when it happens. It gets you every time
20	Stopped what I was doing, jumped.
21	Jumped up from table. (Once heard one when)... sneaking up on elk & they milled around
23	Once in a while but you know what it is. Horse jumps, could be problem near precipice
6	When it is was loud, makes me jump
6	When you don't hear anything before. Then you jump up & see what the ruckus is & go back to what were doing

6 It scares the heck out of you
 b Like an explosion, could be similar to ..(sound from nearby industry)
 c Sometimes startles if doing dishes and day dreaming
 d Curiosity. What caused it...explosion in town, gunshot, firecracker. Thunder shakes more
 e Dropped a coke one day, (it was)..empty anyway
 j Feeling like house will blow up like balloon & then air goes back to normal like a cartoon.
 j Get a jolt from the boom
 k Worst thing...spilled water
 k Like someone scaring you from behind
 k "Assumed" made heart beat faster
 k Sounds like could be a bump in coal mine when might explode
 l Children scream. Unnerve..(her).. for a moment until children calmed down
 m Similar to someone sneaking up behind you and poking you in ribs
 m Made..(him).. flinch and laugh after
 o Heart, leaves (her) panting. Feels like can't breathe, heart beats fast
 o With trucks you can prepare yourself, booms come out of the blue and wham
 p Don't know they are coming-like a kid's firecracker
 t Scares every time, no matter how used to it
 22 Go up lookout tower with pack on back. Boom. Almost fell down steps. Jumped & fortunately got hooked on trap door

Reasons for answers to question about whether people should complain about booms if they are annoyed

Respond-
ent

ID#	Comment
10	They should if it breaks up the tranquility. They should at least investigate the situation
10	Well, if annoyed should complain. Then again, there are so many other sounds here that are more annoying
11	Need to learn to fly planes for protection
12	Yea, if they are annoyed
13	If they started up again, they should
16	If harm, yes, but aren't there worse things? Yes, if children frightened, but it's like thunderstorm
17	They aren't hurting nothing. If they are doing something for you ..(he is).. for it. If it is unnecessary, then no.
18	..(yes).. I guess if they were really bothered, but it's for our well-being (ie. flights are needed for national defense)
19	Not much to complain about

22 If truly annoyed, should try, but (do) not think anything
they (the authorities) can do
23 If damaged, yes: if irritated, no.
3 Well, yes, if they were annoyed, sure
5 If they were annoyed, but they haven't been (ie. not enough
planes) for years
7 People should say what they .(think).. & but then ..(the)..
responsible people deal with it
8 They're not often enough to complain
b ..(yes).. If cracks in wall
c If really bothers them

APPENDIX D: FINAL SONIC BOOM QUESTIONNAIRE
ENVIRONMENTAL SURVEY

COMPLETE THE FOLLOWING ITEMS BEFORE BEGINNING THE INTERVIEW.

- Q1. Date of interview
 (Mo) (Dy) (Yr)
- Q2. Interviewer ID
- Q3. Questionnaire ID
- Q4. Time interview starts 1 AM
 (Hr) (Min) 2 PM
- Q5. Sex of respondent 1 MALE
 2 FEMALE

Hello. My name is . I am calling from (name of firm) . We are conducting a national interview survey for the U.S. Department of about the advantages and problems of living in different areas. I would like to talk to you right now if that is convenient. It should take only about 10 or 20 minutes. You are not required to participate, but it will be very helpful if you do. If it's all right with you, let me start with the first question.

- Q6. How do you feel about this area, the neighborhood or region right around here? What are the one or two things you like most about this area, that is, the things you feel are advantages and make it a good place to live?
- Q7. How about any things you particularly dislike about this area, that is things which are disadvantages. What are the one or two things that you dislike the most about this area? (RECORD ALL PHRASES DESCRIBING ENVIRONMENTAL NUISANCES VERBATIM)

Q8. Now I have some questions about noises which you might have heard when you have been at home.

a Do you ever hear the noise from(cars or trucks on a street or highway)... when you are at home?

[COMPLETE a BEFORE STARTING b]

b [ASK FOR EACH SOUND HEARD] Does the noise from ...(MENTIONED SOUND)...bother or annoy you very much, moderately, a little or not at all?

	a. HEARS			b. BOTHERS OR ANNOYS				
	YES	NO	DK	VERY MUCH	MODERATELY	A LITTLE	NOT AT ALL	DK
i. Cars or trucks on a street or highway	YES	NO	DK	VERY	MOD	LITTLE	NOT	DK
ii. Motorcycles	YES	NO	DK	VERY	MOD	LITTLE	NOT	DK
iii. Neighbors' tools or yard equipment	YES	NO	DK	VERY	MOD	LITTLE	NOT	DK
iv. Helicopters	YES	NO	DK	VERY	MOD	LITTLE	NOT	DK
v. Sonic booms from jets	YES	NO	DK	VERY	MOD	LITTLE	NOT	DK
vi. Ordinary jet aircraft	YES	NO	DK	VERY	MOD	LITTLE	NOT	DK
vii. Any other airplanes (DESCRIBE) _____	YES	NO	DK	VERY	MOD	LITTLE	NOT	DK
viii. Any other explosions, or bangs or booms? (DESCRIBE) _____	YES	NO	DK	VERY	MOD	LITTLE	NOT	DK
ix. Any other noises (DESCRIBE) _____	YES	NO	DK	VERY	MOD	LITTLE	NOT	DK

[IF SONIC BOOM IS NOT HEARD, SKIP TO Q28 AT END OF QUESTIONNAIRE]

Q9. How often do you hear the sonic booms from jets here?
[DO NOT READ CODE CATEGORIES]

- 1 LESS OFTEN THAN ONCE A YEAR
- 2 AT LEAST ONCE A YEAR (INCLUDES LESS THAN ONCE A MONTH)
- 3 AT LEAST ONCE A MONTH
- 4 AT LEAST ONCE A WEEK
- 5 AT LEAST ONCE A DAY

Now I have a few quick questions about sonic booms. I just need short answers from you now. We will get more details in other questions in a moment.

- Q10. a Do the sonic booms from jets ever...(READ EACH ITEM).....? [CONTINUE WITH b AND c]
- b. [ASK FOR EACH INTERFERENCE] How often does that happen? Does it happen very often, fairly often, or only occasionally?
- c. When it happens does it make you feel very annoyed, moderately annoyed, only a little annoyed or not at all annoyed?

		a. OCCUR				b. HOW OFTEN				c. HOW ANNOYED			
		YES	NO	DK		VERY OFTEN	FAIRLY OFTEN	OCCASIONALLY	DK	VERY ATTELY	MODERATELY	LITTLE	NOT AT ALL
		YES	NO	DK		VERY OFTEN	FAIRLY OFTEN	OCCASIONALLY	DK	VERY ATTELY	MODERATELY	LITTLE	NOT AT ALL
i.	Interfere with your radio or TV	YES	NO	DK		VERY OFTEN	FAIRLY OFTEN	OCCASIONALLY	DK	VERY ATTELY	MODERATELY	LITTLE	NOT AT ALL
ii.	Startle or frighten anyone in your family	YES	NO	DK		VERY OFTEN	FAIRLY OFTEN	OCCASIONALLY	DK	VERY ATTELY	MODERATELY	LITTLE	NOT AT ALL
iii.	Disturb your family's sleep	YES	NO	DK		VERY OFTEN	FAIRLY OFTEN	OCCASIONALLY	DK	VERY ATTELY	MODERATELY	LITTLE	NOT AT ALL
iv.	Make your house rattle or shake	YES	NO	DK		VERY OFTEN	FAIRLY OFTEN	OCCASIONALLY	DK	VERY ATTELY	MODERATELY	LITTLE	NOT AT ALL
v.	Interfere with your family's rest or relaxation	YES	NO	DK		VERY OFTEN	FAIRLY OFTEN	OCCASIONALLY	DK	VERY ATTELY	MODERATELY	LITTLE	NOT AT ALL
vi.	Interfere with your conversation	YES	NO	DK		VERY OFTEN	FAIRLY OFTEN	OCCASIONALLY	DK	VERY ATTELY	MODERATELY	LITTLE	NOT AT ALL

The rest of these questions are about only your own experiences.

Q11. Have the sonic booms ever surprised or startled you?

1. YES||
2. NO (SKIP TO Q12, NEXT PAGE)

- a. Have the sonic booms only surprised you or have they actually frightened or scared you?
 1. ONLY SURPRISED
 2. FRIGHTENED/SCARED
- b. Has a sonic boom ever startled you so much that you made a jerky movement?
 1. YES
 2. NO
- c. Has a sonic boom ever made you drop something or fall?
 1. YES
 2. NO
- d. When have you been the most startled or surprised by sonic booms? Were you the most startled when you first heard them, are you most startled now, or has it always been about the same?
 1. AT FIRST
 2. NOW
 3. ALWAYS SAME
- e. In just the last 12 months, how often, if at all, have you been startled or surprised by a sonic boom? Have you been startled or surprised at least once a week, at least once a month, at least one time, or have you not been startled or surprised even once in the past 12 months?
 1. WEEKLY
 2. MONTHLY (12+ TIMES)
 4. AT LEAST ONCE (1 TO 11)
 5. NONE (IN THIS YEAR)
- f. Now, to sum up your feelings about being startled or surprised by sonic booms, would you say that being startled or surprised makes you feel very annoyed, moderately annoyed, a little annoyed or not at all annoyed?
 1. VERY
 2. MODERATELY
 3. A LITTLE
 4. NOT AT ALL

The next questions ask about whether you have noticed different things vibrating or rattling or shaking or ever felt anything when there has been a sonic boom.

Q12. When you have heard a sonic boom, have you ever noticed ...(windows rattle or shake)...? [CONTINUE WITH ii)

	YES	NO	DON'T KNOW
i. windows rattle or shake	1. YES	2. NO	3. DK
ii. pictures or mirrors or decorations, or dishes or other things on shelves or the wall rattle or move	1. YES	2. NO	3. DK

Q13. Have you ever actually felt the furniture or the floor or the house vibrate?

1. YES 2. NO

[ASK IF NO TYPE OF VIBRATION MENTIONED IN Q.12 OR Q.13]

Q14. Have the sonic booms ever made anything in your house rattle or shake or vibrate?

1. YES (CONTINUE) 2. NO (SKIP TO Q16, NEXT PAGE)

Q15. Now, to sum up your feelings about the vibrations, would you say that the rattling or shaking or vibrating makes you very annoyed, moderately annoyed, a little annoyed or not at all annoyed?

1. VERY
2. MODERATELY
3. A LITTLE
4. NOT AT ALL

ASK ALL

Q16.a Now consider any things that have broken or been damaged around your home in the last few years. Have you ever thought that the booms might have had anything to do with any of these things being broken or damaged?

1. YES !! 2. NO (SKIP TO Q17)

b What things do you think might have been broken or damaged by the boom? (RECORD DESCRIPTION OF ITEM AND DAMAGE IN GRID BELOW.)

c About what month and year was it when you noticed that damage? (ENTER DATE)

[COMPLETE b AND c BEFORE ASKING d]

d We would like to know how certain you are about what caused the damage. For the(DAMAGE, ITEM)... are you very certain, moderately certain, moderately uncertain or very uncertain that the damage was caused by the sonic boom?

b.		c. DATE		d.			
ITEM	DAMAGE	YEAR	MONTH	VERY CERTAIN	MODERATELY CERTAIN	MODERATELY UNCERTAIN	VERY UNCERTAIN
i.				1	2	3	4
ii.				1	2	3	4
iii.				1	2	3	4

Q17. Have you ever thought that the booms might make your house unsafe?

1. YES!! 2. NO [GO TO NEXT QUESTION]

a. How certain or uncertain are you about whether the sonic booms could make your house unsafe: very certain, moderately certain, moderately uncertain or very uncertain?

1. VERY CERTAIN
2. MODERATELY CERTAIN
3. MODERATELY UNCERTAIN
4. VERY UNCERTAIN

Q18. Do you have any animals or livestock or any types of pets?

1. YES!! 2. NO [SKIP TO Q19]

a. What types of animals are they?

b. Have they been disturbed by the sonic booms, or not, or do you not know?

1. YES!! 2. NO [SKIP TO Q19] 3 DON'T KNOW [SKIP TO Q19]

c. What do you notice about them when they are disturbed?

d. Have you ever lost any money or had to spend any money because the animals were disturbed by the sonic booms?

1. YES-- [PROBE IF NECESSARY "How did that happen? Which animals were those?"]

2. NO

Q24. Now we will ask you to rate the sonic booms, but this time using a number from zero to 10. Zero means "not at all disturbed" and 10 means "unbearably disturbed". During the daytime when you are here at home how would you compare the sonic booms inside and outside the house?

First how would you rate the sonic boom when you are inside your house? Choose zero if you are not at all disturbed, 10 you are unbearably disturbed and a number from 1 to 9 if you are somewhere in between.

_____ Number

Q25. Now how would you rate the sonic boom when you are outside your house here?

(REPEAT IF NECESSARY...Choose zero if you are not at all disturbed, 10 if you are unbearably disturbed and a number from 1 to 9 if you are somewhere in between.)

_____ Number

[ASK IF RATINGS ARE NOT THE SAME]

Q26. So you feel the booms are worse (...inside/outside....) the house. Why are they worse for you there?

[DO NOT PROMPT. CIRCLE PRECODE IF OFFERED, RECORD VERBATIM IF OTHER]

	<u>Mentioned as worst</u>	<u>Not mentioned</u>
VIBRATION, RATTLE, SHAKE	1	0
STARTLE, SURPRISE	1	0
NOISIER, LOUDER (GENERALLY)	1	0
OTHER (Describe) _____	1	0

Q27. We have asked about several ways that sonic booms can affect people. Now to sum it up, for you personally what is the single most disturbing thing about the sonic booms: is it the vibration and rattle, or the surprise and startle, or the loudness of the booms, or is it something else?

1. VIBRATION, RATTLE
2. STARTLE, SURPRISE
3. LOUDNESS
4. OTHER (DESCRIBE)

Now I have a few last background questions

Q28. How much of the time do you spend within about ten miles around here and how much of the time are you further away. In an average week, about how many hours are you at least ten miles away from your home?

(HOURS)

Q29. Including yourself, how many adults, that is people over 18, live in your household?

(NUMBER)

Q30. When did you move to this address? _____
(MO) (YR)

Q31. What year were you born? _____

**APPENDIX E: PRETEST DATA PRESENTATION QUESTIONNAIRE
ENVIRONMENTAL SURVEY**

-
- Q1. Date: _____
(Month/Day/Year)
- Q2. Interview No.: _____
- Q3. Place of Interview: _____
(City/State)
_____ (Home/Not Home)
- Q4. Time Interview Starts: _____ (AM/PM)
-

Hello, my name is _____. I am testing a survey for the National Aeronautics and Space Administration. The survey concerns what you think about the environment where you live. We would like to learn from you about the advantages and the problems of this area. I would like to talk to you right now if that is convenient for you. This interview should take only about 10 to 20 minutes. If it's all right with you, let me start with the first question:

- Q5. We are particularly interested in your impressions over the past several years. How long have you lived in this community?

YEARS	UTAH	I/W
-----	-----	-----
0-14	6	4
15-29	5	5
30-44	3	7
45-59	3	2
60-+	4	5
	-----	-----
	n=21	n=23

If more than 18 months, continue.

If less than 18 months, go to background items.

- Q5a. Do you work nearby in this community?

SURVEYS IV-VIII (I/W)

YES	11
NO	3
RETIRED	5
DISABLED	1

	n=20

Q5b1. [if YES to Q5a]
About how many miles is that from your home?

SURVEY V-VIII

RESPONSES: 3 blocks (1), 1 mile (2), 2 miles (1), 3 miles (1), 40 miles (1), "it varies" (1) n=7

Q5b2. How long have you worked in this community?

SURVEY IV (I/W)

RESPONSES: at least 2 years, 9 years n=2

Q5c. And about how long have you worked there?

SURVEY V-VIII (I/W)

RESPONSES: 1 years, 15 years, 16 years, 20 years, 54 years n=5

Q5d1. How much of the time does your work/activities keep you outside of a building? Would you say, always (6), almost always (5), usually (4), about half (3), somewhat often (2), or almost never (1). [NUMBERS ARE FOR DATA ANALYSIS ONLY.]

SURVEY IV (I/W)

AVERAGE: 3.16 n=6

Q5d2. How many hours of the day are you normally outdoors?

SURVEY V-VIII

RESPONSES: 1-5 hours (6), 6-10 hours (4), 11-18 hours (4) n=14

Q6. How do you feel about this area, the block or region around here? What are the one or two things you have liked most about this area, that is, the things you feel are advantages and make it a good place to live?

RESPONSES: Positive features of the environment most frequently mentioned in both survey areas were the "small town" and "rural" aspects. Other descriptions common to both areas were "quiet" and "peaceful," "friendly people" and "fresh air."

Q7. Most areas have a few disadvantages also. What are one or two things that you may have disliked around here in the last several years?

RESPONSES: There were only two complaints offered about noise and no comment at all about sonic booms in this item. Criticisms common to both survey areas included limited entertainment for youth, the lack of industry and jobs, and the lack of rain, especially in Utah.

Q8. Now I have some questions about noises in or around the home [or work, if nearby]. What are the main noises you have heard in the last several years around here?

RESPONSES: Sonic booms were volunteered by 5 people as the main noise in both survey areas (UT=3, I/W=2). The most frequent noise reported by both areas was traffic (UT=13, I/W=9). The next most frequent response was dogs (UT=3) and planes (I/W=4).

[COMPLETE "A" BEFORE STARTING "B"]

Q8a. Now I just need to know if you hear some particular noises around here. Have you ever heard noises from ... (cars or trucks on the street or highway ...) at home (or work if nearby).

Q8b. [SELECT ALT. 1 OR ALT. 2]

ALT 1.: Now I need for you to show me how much these sounds bothered or annoyed you by using the following description:

Please indicate whether the noise from ...[MENTION SOUND] bothered or annoyed you very much, moderately, a little, or not at all.

ALT 2.: Now I need to know how bothered or annoyed you are by each of the sounds using a number from 0 to 3. Use 0 for not at all, 1 for a little, 2 for moderately, and 3 for very much. How much are you bothered or annoyed by [mentioned sound]:?

(Q8. Continued)

a. HEARS				b. BOTHERS OR ANNOYS (AVERAGE) 3-VERY MUCH, 2-MODERATELY 1-A LITTLE, 0-NOT AT ALL
	YES	NO	DK	
i. Cars or trucks on the street or highway:				
UT:	17	3 n=20	0	1.13
I/W:	15	5 n=20	0	0.67
ii. Motorcycles:				
UT:	14	5 n=19	0	1.00
I/W:	13	8 n=21	0	1.08
iii. Any other road traffic (DESCRIBE):				
UT:	5	12 n=17	0	1.25
I/W:	5	13 n=18	0	0.83
iv. Trains:				
UT:	10	8 n=18	0	0.08
I/W:	8	12 n=20	0	0.13
v. Neighbors' tools or yard equipment:				
UT:	13	5 n=18	0	0.33
I/W:	10	10 n=20	0	0.33
vii. Helicopters:				
UT:	9	10 n=19	0	0.00
I/W:	13	7 n=20	0	0.23

(Q8. Continued)

a. HEARS

b. BOTHERS
OR ANNOYS

(AVERAGE)

3-VERY MUCH, 2-MODERATELY

1-A LITTLE, 0-NOT AT ALL

YES NO DK

viii. How about the sonic booms from jets at any time during the last several years?:

UT: 19 2 0 1.12
n=21

I/W: 21 1 0 1.55
n=22

[ASK IF HEAR SONIC BOOM]

a. What was it like? (Could you DESCRIBE it for me?)

See Appendix D

(for the next 3 items, the value of the average response is referenced to the following descriptors: 3-very much, 2-moderately, 1-a little, 0-not at all)

viii-a1 How bothersome was it when you first heard a sonic boom?

SURVEYS VII-VIII

I/W: Average = 1.67 n=5

viii-a2 How bothersome or annoying was it when they were more frequent a few years ago?

SURVEYS VI-VIII

I/W: Average = 2.80 n=8

viii-a3 How bothersome or annoying is it now?

SURVEYS VI-VIII

I/W: Average = 1.71 n=7

viii-b1 Is "sonic boom" the term that people use around here?

SURVEY III

	YES	NO	n
	---	--	--
UT:	6	0	6

viii-b2 Do people around here call it the "sonic boom" or do they sometimes call it Something Else (SE)?

SURVEY V-VIII

	YES	SE	n
	---	--	--
I/W	12	0	12

(Q8. Continued)

	a. HEARS			b. BOTHERS OR ANNOYS (AVERAGE) 3-VERY MUCH, 2-MODERATELY 1-A LITTLE, 0-NOT AT ALL
	YES	NO	DK	

ix. Any other jet aircraft:

UT:	8	9	0	0.22
		n=17		

I/W:	12	9	0	0.67
		n=21		

x. Any other airplanes (DESCRIBE):

UT:	8	8	0	0.14
		n=16		

I/W:	13	3	0	0.67
		n=16		

[ASK IF NO SONIC BOOM ABOVE]

xi. Over the last several years, other sounds like an explosion or thunder that might have come from jets when they break the sound barrier? What was it like? Can you describe it?

UT:	1	1	0	2.00
		n=2		

I/W	1	0	0	1.00
		n=1		

[ASK ALL]

xii. Any other explosions, or bangs and booms? (DESCRIBE)

UT:	3	13	0	0.50
		n=16		

DESCRIPTION: Earthquakes (2 comments), Fourth of July, blasting at north of canyon and rifle range.

I/W:	4	16	0	0.00
		n=20		

DESCRIPTION: Shotgun and rifle, car backfire, jake breaks and highway construction

(Q8. Continued)

a. HEARS

**b. BOTHERS
OR ANNOYS**

(AVERAGE)

3-VERY MUCH, 2-MODERATELY

1-A LITTLE, 0-NOT AT ALL

YES NO DK

xiii. Any other noises? (DESCRIBE):

UT: 9 5 0 0.44
n=14

DESCRIPTION: Dogs, mining gypsum (dynamite), neighbors' sheep, firecrackers, alarms, kids with stereo in car, cows.

I/W: 8 8 0 1.67
n=16

DESCRIPTION: Crop dusters, fire trucks, driers from grain elevators, chain saws, frat parties, dogs, kids, magpies in spring, air conditioning, mill noise, mill whistle.

[IF SONIC BOOMS NOT HEARD, GO TO BACKGROUND QUESTIONS]

[ASK QUESTIONS 9 AND 10 ONLY IF QUESTION 8 USED VERBAL TERM FOR ANNOYANCE]

Q9. Now we will ask you to rate some noises with a number from zero to four, zero means not at all disturbed and four means extremely disturbed, two means about average. The first sounds are from cars or trucks on a street or highway around here. How much are you bothered or annoyed by the noise from cars or trucks on a street or highway around here? (Choose zero if you are not at all disturbed, four if you are extremely disturbed and one, two or three if you are somewhere in between.

UT: Average: 1.0 n=18
I/W: Average: n/a This response mode applied to item 8

Q10. What number would you give to sonic booms? (Or,) How bothered or annoyed were you by the sonic booms from the jets? Again choose zero if you were not at all disturbed, four if you were extremely disturbed and one, two or three if you were somewhere in between.

UT: Average: 2.22 n=18
I/W: Average: n/a This response mode applied to item 8

Q10a. Do you know what causes sonic booms?

SURVEY VIII

	YES	NO	n
	---	--	--
I/W	7	0	7

DESCRIPTION: Jet breaking sound barrier. Plane going faster then 700 mph.

Q10b. Have you heard sonic booms elsewhere?

SURVEY VIII

	YES	NO	n
	---	--	--
I/W	6	0	6

Q10c. Are they different here?

SURVEY VIII

	YES	NO	n
	---	--	--
I/W	3	3	6

Description: Booms are louder here (2) n=2

Q11. Have the sonic booms ever surprised or startled you?
(Q15).

1. NO (SKIP TO NEXT QUESTION) 2. YES++

	YES	NO	n
	---	--	--
UT:	16	0	16
I/W:	18	4	22

x. What happened then (See Appendix D for additional description)?

	UT	I/W
• Didn't bother interviewee	0	7
• Startle effects (change in behavior, e.g., kid's cry)	9	9
• Physical manifestation (e.g., windows shake)	3	3
n =	12	19

a. What is the worst thing that has ever happened when a boom surprised or startled you? (RECORD PHRASES VERBATIM)

	UT	I/W
• Nothing	5	9
• Startle effects (change in behavior, e.g., heart skipped)	6	4
• Physical manifestation (e.g., shakes house)	0	2
• Accident (e.g., dropped can of soda)	3	1
n =	14	16

(Q11. Continued)

b. [IF NECESSARY] How did you feel when that happened?

	UT	I/W
• "Scared"/"Startled"	5	2
• "Mad"/"Angry"	2	2
• "O.K."	1	-
• "Dumb"	1	-
	<u>1</u>	<u>-</u>
	n = 9	4

c. Has a sonic boom ever startled you so much that (STARTLE RESPONSE)...? [CONTINUE WITH d and e]

d. ALT 1: Overall, would you say that you were bothered or annoyed very much, moderately, a little or not at all because some booms startled you so much that...(STARTLE RESPONSE)...?

ALT 2: Please show how bothered or annoyed you were by using the numbers 0 to 3 as you did before: Use 0 for not at all, 1 for a little, 2 for moderately and 3 for very much.

e. About how many times has a boom startled you so much that ...(RESPONSE)...? [RECORD NUMBER OF TIMES OR, IF THERE ARE TOO MANY, THE FREQUENCY PER WEEK, MONTH OR YEAR]

	c. OCCURS			d. BOTHERS OR ANNOYS (AVERAGE) 3-VERY MUCH, 2-MODERATELY 1-A LITTLE, 0-NOT AT ALL	e. HOW OFTEN	
	YES	NO	DK		(SOME- TIMES)	(ALMOST ALWAYS)
i. you made a jerky movement?						
UT:	13	5	1	1.58	4	3
		n=19				
I/W:	7	11	1	2.13	2	3
		n=19				
ii. it made your heart beat faster or left you feeling a bit weak?						
UT:	9	9	0	1.5	2	2
		n=18				
I/W:	5	13	1	1.75	2	0
		n=19				

Q12a. When did you last hear a sonic boom?
(Q9x).

SURVEYS I-VIII

	Utah n=21	I/W n=22
Less than a month ago	2	6
About a month ago	8	2
2-6 months ago	3	3
7-12 months ago	2	4
13-24 months ago	3	0
Unrelated response	1	0
Can't remember/DK	2	7

(IF DK to above item) Please give a rough estimate of the last time you heard a sonic boom.

I/W: about a year ago, 2 months ago, don't know, several months, a few months ago, 2-6 months ago, maybe a month. n=7

(IF DK to above item) Do you think it may have been within the last month or the last year?

I/W: maybe a year. n=1

Q12b. How often do they occur now?

SURVEY II-III

UT: Weekly (1), monthly (2), yearly (2), none (2). Not for quite a while. Not as much as they used to. Heard a couple this spring and summer. (n=10)

SURVEY V-VIII

I/W: Weekly (2), monthly (4), yearly (2), DK (4). (n=12)

Q12c. Have you noticed a change in how often they have occurred?

SURVEY II-VIII N=12,20

	YES	NO	DK
	---	--	---
UT:	10	2	N/A
I/W:	10	6	4

- When did you notice the change? SURVEY II-III (UTAH)
- When do you think the change occurred? SURV IV-VIII (I/W)

	Utah n=7	I/W n=8
About 1 month ago	1	0
In the last 12 months	1	2
In the last 13-24 months	3	0

(Cont'd)

(Q12c cont'd from previous page)

In the last 5 years	1	4
8-10 years ago	0	2
(realized change only during interview)	1	0

Q12d. How often did you hear the sonic booms from jets here. (If (Q9). noticed change in frequency, ask for estimate before change).

	Utah n=19	I/W n=18
Yearly	3	3
Monthly	3	4
Weekly	6	9
Daily	7	2

Q12e. [If heard boom] Were you able to get used to them?

SURVEY VIII

	YES	NO	n
	---	--	--
I/W:	3	2	5

Q12f. [If heard boom before] How would you feel if you heard the booms as much as you used to?

SURVEY VIII

I/W:	- Annoyed if more windows broke
n=4	- wouldn't really like them
	- wouldn't like it (don't know if it's a necessary evil
	- wouldn't like it (would start diary again)

Q13a. Did the sonic booms from jets ever ...(READ EACH ITEM)... ?
[CONTINUE WITH Q13b AND Q13c]

Q13b. [ASK FOR EACH INTERFERENCE]

ALTERNATE 1: Did that happen very often, fairly often, or only occasionally?

ALTERNATE 2: Did that happen for most of the booms, half of them, or just a few?

Q13c. ALTERNATE 1: When it happened did it make you feel very annoyed, moderately annoyed, only a little annoyed or not at all annoyed?

ALTERNATE 2: Please show how bothered or annoyed you were by using the numbers 0 to 3 as you did before: How much did (mention item) bother you?

Did Sonic Booms from jets ever ...(!) ?

	a. OCCUR			b. HOW OFTEN	c. HOW ANNOYED
	YES	NO	DK	3-VERY OFTEN, 2-FAIRLY OFTEN, 1-(OCCAS.)	3-VERY, 2-MODERATELY 1-A LITTLE, 0-(NONE)
i. interfere with your radio or TV?					
UT:	1	17	0	2.0	2.0
	n=18				
I/W:	0	18	0	n/a	n/a
	n=18				
ii. startle or frighten you or anyone else in your family?					
UT:	15	4	0	2.25	1.47
	n=19				
I/W:	8	11	0	2.0	2.0
	n=19				
iii. disturb your family's sleep?					
UT:	6	12	0	1.67	2.5
	n=18				
I/W:	5	15	0	1.6	2.29
	n=20				
iv. make your house rattle or shake?					
SURVEYS I-IV					
UT:	17	2	0	1.7	1.44
	n=19				
I/W:	5	1	0	2.25	1.6
	n=6				
v. interfere with your family's rest or relaxation?					
UT:	0	10	0	n/a	n/a
	n=10				
I/W:	2	17	0	2.0	2.5
	n=19				

(Q13c. Continued)

	a. OCCUR			b. HOW OFTEN 3-VERY OFTEN, 2-FAIRLY OFTEN, 1-(OCCAS.)	c. HOW ANNOYED 3-VERY, 2-MODERATELY 1-A LITTLE, 0-(NONE)
	YES	NO	DK		
vi. interfere with your conversation?					
UT:	12	6	0	1.57	0.75
	n=18				
I/W:	6	14	0	2.6	1.2
	n=20				

Q14i. Were there ever times when you just felt the boom itself
(Q17). without feeling anything else moving?

SURVEYS I - IV:

	YES	NO	n
	---	--	--
UT:	10	10	20
I/W:	3	3	6

Q14ii. Were there ever times when you just felt the boom itself
(Q17). without noticing anything else vibrating?

SURVEYS V - VIII:

	YES	NO	DK	
	---	--	--	
I/W:	6	7	2	n=15

[IF DK] Did you feel the boom with your body without noticing
anything else move?

	YES	NO	
	---	--	
I/W:	1	1	n=2

Q14x. How did that feel?
(Q17x).

UT: See Appendix D
I/W: See Appendix D

[CHOOSE ALTERNATE: 1 OR 2]:

Q14a. ALTERNATE 1: Overall would you say that feeling the boom
(Q17a). itself bothered or annoyed you very much, moderately, a
little or not at all?

ALTERNATE 2: Please rate how bothered or annoyed you
were about feeling the boom itself with a number from
zero to three as you did before.

VERY MUCH (3), MODERATELY (2),
A LITTLE (1), NOT AT ALL (0)

UT: Average: 1.43 n=7
I/W: Average: 1.83 n=12

Q14b. How many of the booms were like that so that you just felt the
(Q17b). boom itself; more than half, less than half or about half of
the booms (These responses break down further into the
following 6 responses):

ALWAYS (6), ALMOST ALWAYS (5), USUALLY (4),
ABOUT HALF (3), ALMOST NEVER (2), SOMEWHAT OFTEN (1)

UT: Average: 3.2 n=5
I/W: Average: 3.1 n=9

Q15. Have you ever noticed different things vibrating or shaking or
(Q16). rattling when there has been a sonic boom?

	YES	NO	n
UT:	15	3	18
I/W:	16	2	18

x. What was it that you noticed? (IF NECESSARY ... How could
you tell it was moving?)

UT: Window, door, house, chandelier, china
 cabinet, knick knacks, and pictures.

I/W: Windows, house, dishes, dresser latch,
 cabinet.

a. When you have heard a sonic boom, have you ever noticed ...
(windows rattle or shake)...? [CONTINUE WITH b and c]

b. Select Alternate 1 or 2 for next item:

ALTERNATE 1: [ASK FOR EACH TYPE OF MOVEMENT NOTICED]
Overall would you say that you were bothered or annoyed
very much, moderately, a little or not at all?

ALTERNATE 2: Please rate how bothered or annoyed you
were with a number from zero to three as you did before.

c. Select Alternate 1 or 2 for next item:

ALTERNATE 1: How many of the booms made... (NOTICED
ACTION)...; more than half, less than half, or about half
of the booms? [ASK FOLLOW-UP QUESTIONS IF NOT HALF.
MARK ALL ANSWERS IN GRID]

MORE THAN HALF: Would you say that the booms always, almost always or only usually made... (NOTICED ACTION)...?

ABOUT HALF: (Go to next item.)

LESS THAN HALF: Would you say that the booms almost never made... (NOTICED ACTION)... or that they did it somewhat often?

ALTERNATE 2: How often did the booms make the... (NOTICED ACTION):

ALWAYS (6), ALMOST ALWAYS (5), USUALLY (4) HALF THE TIME (3), SOMEWHAT OFTEN (2), ALMOST NEVER (1)
[NUMBERS ARE FOR DATA ANALYSIS ONLY]

		c. OCCURS			d. BOTHERS OR ANNOYS (AVERAGE) 3-VERY MUCH, 2-MODERATELY 1-A LITTLE, 0-NOT AT ALL	e. HOW OFTEN (AVERAGE) 6-ALWAYS... 1-ALMOST NEVER
		YES	NO	DK		
i.	windows rattle or shake					
	UT:	16	3	0	1.50	3.79
			n=19			
	I/W:	16	4	2	1.39	3.46
			n=22			
ii.	pictures or mirrors or decorations, or dishes or other things on shelves move or rattle					
	UT:	4	15	0	2.00	3.67
			n=19			
	I/W:	10	12	0	1.11	2.56
			n=22			
iii.	furniture or the floor vibrate or shake:					
	UT:	3	16	0	2.00	3.00
			n=19			
	I/W:	6	16	0	1.83	3.17
			n=22			
iv.	any other objects move or rattle or shake or vibrate (DESCRIBE):					
	UT:	0	19	0	n/a	n/a
			n=19			
	I/W:	3	19	0	1.00	1.00
			n=22			

DESCRIPTION OF YES RESPONSES FOR iv:

UT: n/a

I/W: House shook, curtains moved, chandelier moved.

- Q16. a. Now consider any things that have been broken or
(Q18). damaged around your home in the last few years. Have you
ever thought that the booms might have had anything to do
with any of these things being broken or damaged in your
house?

	NO (SKIP TO NEXT QSTN.)	YES	n
	--	---	--
UT:	17	3	20
I/W:	15	7	22

- b. What things do you think might have been broken or damaged
by the boom? (ENTER DESCRIPTION OF ITEM AND OF DAMAGE AND
ASK c FOR ALL BEFORE ASKING d)

UT: Cracks in: Plaster ceiling, wall and corner
of foundation.

I/W: Cracks in: Wall, chimney, small windows,
ceiling, thermopane window seal, and loosened
window caulking.

- c. About what month and year was it when you noticed the
damage? (ENTER DATE)

UT: Within last three years (1)
Twenty years ago (1) n=2

I/W: Within last two years (2)
Between three to nine years ago (2)
Ten years ago (3) n=7

[COMPLETE b AND c BEFORE ASKING d]

- d. Our engineers want to know just how certain or uncertain you
are about what caused that damage.

For the ...(DAMAGE, ITEM)... were you very certain (3),
moderately certain (2), or moderately uncertain (1) that the
damage was caused by the sonic boom [NUMBERS ARE FOR DATA
ANALYSIS ONLY.]?

AVERAGE:

UT:	1.67	n=3
I/W:	1.71	n=7

Q17a. Have you ever thought that the booms might make your house
(Q19). unsafe?

SURVEYS I-IV:

	YES ---	NO --	n --
UT:	7	10	17
I/W:	1	5	6

Q17b. Have you ever thought that the booms might weaken your house?
(Q19).

SURVEYS V - VIII:

	YES ---	NO --	n --
I/W:	2	13	15

x. How do you think they might do that?

UT: Boulder could jam loose above the house.
Ceiling tile and siding could loosen.
Foundation wall could crack. Large windows
could crack/fall out. Door could come loose.

I/W: Window would break (only early survey item).
Glass skylight would break. Basement wall
would crack.

a. How certain or uncertain are you about whether the sonic
boom could weaken your house: very certain (3), moderately
certain (2), or moderately uncertain (1)? (NUMBERS ARE FOR
DATA ANALYSIS ONLY.)

UT:	1.6	n=5
I/W:	1.0	n=3

Q18a. Have you ever heard anyone around here say that they thought a
(Q20). boom could make a house unsafe?

SURVEYS I-IV:

	YES ---	NO --	n --
UT:	4	16	20
I/W:	0	6	6

Q18b. Have you ever heard anyone around here say that they thought a
(Q20). boom could weaken their house?

SURVEYS V-VIII:

	YES ---	NO --	n --
I/W:	3	13	16

Q19. Did you ever think that there was a danger that one of those
(Q22). supersonic aircraft might crash in your neighborhood?

	YES ---	NO --	n --
UT:	3	15	18
I/W:	0	18	18

a. Would you say you felt this: very often (3), moderately often (2), or only occasionally (1)? (NUMBERS ARE FOR DATA ANALYSIS ONLY).

UT:	Average:	1.67
I/W:	Average:	n/a

Q20. Do you have any animals or livestock or any types of pets?
(Q21).

	YES ---	NO --	n --
UT:	7	11	18
I/W:	16	5	21

a. What types of animals are they?

UT:	Dog, cat, bird, cows
I/W:	Dog, cat, cows, mink. Also experience with elk, game birds

b. Were they disturbed by the sonic booms, or not, or do you not know?

	YES ---	NO --	DK --	n --
UT	3	4	0	7
I/W	7	8	1	16

c. What did you notice about them when they were disturbed?

UT: Dog pricks up ears, "yipes", looks frightened, goes under car or in window well, bird is startled, cows run around corral.

I/W: Dogs jump up and runaway, jumps under bed, hides in basement, howl for a few seconds, old dog (15-17 yrs old) falls down; cat goes to door to investigate, calves hop up and down (Also game birds shut up for an hour, elk are startled/run away).

d. Have you ever lost any money or had to spend any money because they were disturbed by the sonic boom?

	YES	NO	n
	---	--	--
UT:	0	4	4
I/W:	1*	6	7

*Mink kill and eat their young (This occurred in California)

Q21. Have you, yourself ever done anything about the booms like (Q13). writing or visiting or telephoning an official or someone else to complain about them?

	YES	NO	n
	---	--	--
UT:	0	18	18
I/W:	1	21	22

Q22. Do you think people around here should complain about these (Q14). booms if they were annoyed? (see Appendix D for responses)

	YES	NO	DK	n
	---	--	--	--
UT	4	3	0	7
I/W	15	5	2	22

Q22a. [If response to Q22 is NO, probe why]
(Q14).

SURVEYS V-VIII

I/W: It's something you just expect (for defense). The pilot needs to learn to fly the plane. Not often enough to complain about. They ain't hurting nothing. If they're doing something for you he's for it.

Q23. We would like to know how much of the time you spend within about ten miles around your home and how much of the time you were further away. In an average week, about how many hours were you at least ten miles away from your home?

Hours From Home	UT n=22	I/W n=21
-----	----	----
0-10	12	13
11-20	4	5
21-30	2	1
31-40	0	1
41-50	1	0
51-60	1	1
61-70	0	0
71-80	1	0
Other	*	

* Gone half of summer

Q24. How many people live in your household, including children and adults?

No. of People per Household	No. of Households	
	UT n=22	I/W n=21
-----	----	----
1	7	2
2	6	8
3	5	2
4	2	6
5	1	3
10	1	-

Average no. of people per household: UT = 2.59 I/W = 3.00

Q25. What is your occupation?
(Q26).

UTAH		I/W	
----		---	
Retired	9	Logging/	6
Mgr/Supervisor	5	Forestry	
Housewife	3	Retired	6
County Clerk/	1	Housewife	2
Assistant		Carpenter	2
Power Plant	1	Nurse/EMT	2
Operator		Outfitter	1
Turkey Farm	1	(wildnerness)	
staff		Motel Mgr	1
Baptist	1	Trucking Bus.	1
Minister		(owner)	
Garage	1	Applied	1
Business		Physicist	
		Self	1
		Employed	
	<u>22</u>		<u>23</u>

Q26. Have sonic booms ever been an issue in this community?

	YES	NO	n
	---	--	--
UT:	5	10	15
I/W:	3	19	22

Q27. Is there anybody else that we should talk to in order to gather additional information about sonic booms?

	YES	NO	n
	---	--	--
UT:	2	20	22
I/W:	2	21	23

Q28. Are there any organizations that we should contact?

	YES	NO	n
	---	--	--
UT:	1	21	22
I/W:	1	22	23

Q29. If any other things come up that we need to ask you about, would it be all right to give you a call?

	YES	NO	n
	---	--	--
UT:	19	3	22
I/W:	23	0	23

THANK YOU FOR YOUR COOPERATION

Q30. (If at some point in interview, the interviewee says that "you get used to it (booms)", ask if it was hard to get used to them):

	YES	NO	n
	---	--	--
I/W:	1	2	3



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16. Abstract A preliminary draft questionnaire concerning community response to sonic booms was developed. Interviews were conducted in two communities that had experienced supersonic overflights of the SR-71 airplane for several years. Even though the overflights had ceased about 6 months prior to the interviews, people clearly remembered hearing sonic booms. A total of 22 people living in central Utah and 23 people living along the Idaho/Washington state border took part in these interviews. The draft questionnaire was constantly modified during the study in order to evaluate different versions. Questions were developed which related to annoyance, startle, sleep disturbance, building vibration and building damage. Based on the data collected, a proposed community response survey response instrument was developed for application in a full-scale sonic boom study.					
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